RESTRICTED

Instruction Book

For

Navy Model TBY-8

Ultra-Portable Very-High Frequency

Transmitting-Receiving Equipment

Output	Emission	Frequency Range
0.75 Watts	MCW Telegraphy (A-2)	28 to 80 MCS.
0.5 Watts	Telephony (A-3)	28 to 80 MCS.

Manufactured for

U. S. NAVY DEPARTMENT BUREAU OF SHIPS

—By—

Colonial Radio Corporation

254 Rano St., Buffalo, N. Y.

Contract NXsr 37799 *Date of Contract: September 29, 1943*

ERRATA

Item 1 — Wire with substitute coloring in accordance with the following chart may be supplied in the equipment described in this Instruction Book.
Refer to wire chart contained in Fig. 11 Page 60 of this Book:

Wire No.	Original Color	May Be Supplied As
8	Brown — Red Tracer	Solid Brown
9	Brown — White Tracer	Solid Brown
10	Brown — Green Tracer	Solid Brown
11	Black — Red Tracer	Solid Black
12	Black — White Tracer	Solid Black
13	Black — Green Tracer	Solid Black
14	Black — Yellow Tracer	Solid Black
15	Green — Red Tracer	Solid Green
16	Green — Yellow Tracer	Solid Green
17	Green — White Tracer	Solid Green
18	Blue — Red Tracer	Solid Blue
21	Red — White Tracer	Solid Red
22	Red — Green Tracer	Solid Red

All solid color wires so substituted will have original tracer color painted on each end.

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This document contains information affecting the National Defense of the United States within the meaning of the Espionage ACT (U.S.C. 50: 31, 32). The transmission of this document or the revelation of its contents in any manner to any unauthorized person is prohibited.

This Instruction Book is furnished for the information of commissioned, warranted, enlisted and civilian personnel of the Navy and persons authorized by the Bureau of Ships whose duties involve design, manufacture, instruction, operation, and installation of radio, radar, or underwater sound equipment. The word "RESTRICTED" *as applied* to *this* instruction book signifies that it is to be read only by the above personnel, and that its contents should not be made known to unauthorized persons not connected with the Navy.

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Contract NXsr 37799 *Date of Contract: September 29, 1943*

SPECIAL NOTICE

MAINTENANCE AND OPERATING PERSONNEL ARE INFORMED THAT TO OBTAIN OPTIMUM PERFORMANCE OF THIS EQUIPMENT IT IS IMPERATIVE THAT THE FOLLOWING ESSENTIALS BE ACCOMPLISHED:

1. LEARN THE EQUIPMENT, BOTH MECHANICALLY AND ELECTRICALLY, AS OUTLINED IN THE CONTENTS OF THIS INSTRUCTION BOOK.

2. LEARN THE PECULIAR CHARACTERISTICS IN THE PROPAGATION OF VERY-HIGH FREQUENCIES.

3. TEST EQUIPMENT AT LEAST ONCE EACH WEEK. THIS TEST SHOULD CONSIST OF AN ELECTRICAL INSPECTION AND THE ACTUAL ESTABLISHMENT OF COMMUNICATIONS BETWEEN TWO EQUIPMENTS OF SIMILAR TYPE, USING AT LEAST ONE FREQUENCY IN EACH BAND, OVER A TERRAIN AND AT A DISTANCE FOR WHICH THE EQUIPMENT IS DESIGNED.

4. KEEP ONLY SUFFICIENT STOCK OF DRY BATTERIES TO INSURE AVAILABILITY FOR THE PROPOSED MISSION. ADHERE STRICTLY TO INSTRUCTIONS FOR THE CARE OF DRY BATTERIES WHILE IN STORAGE.

TABLE OF CONTENTS

Page

SECURITY NOTICE 1

SPECIAL NOTE 3

LIST OF ILLUSTRATIONS 6

GUARANTEE 7

INSTRUCTIONS TO OPERATING PERSONNEL REGARDING REPORTS OF FAILURES 8

I. INTRODUCTION 9
- Intent of Design 9
- List of Units 9
- Description—Mechanical 9
- Special Features 10
- List of Components with Weights and Dimensions 10

II. DETAILED DESCRIPTION 11
- Transmitter-Receiver Unit 11
- Mechanical 11
- Electrical Circuits 12
- Transmitter—R.F. Section 12
- Receiver—R.F. Section 12
- Super-Regenerative Detector 12
- Audio Amplifier Section 13
  - Voice Transmission 13
  - MCW Transmission 13
  - Reception 14
  - Audio Circuits, General 14
- Crystal Calibrator Section 14
  - Calibration, General 14
  - Transmitter Calibration 14
  - Receiver Calibration 14
  - Control Relay 14
- Indicating Meter 15
- Battery—Navy Type CNC-19018B 15
- Battery Rating and Performance 15
- Key, Cord and Plug Assembly—Navy Type CRH-26013B 15
- Microphone-Headphone Assembly—Navy Type CTE-51022B or CTE-51022C 16

III. PACKING, UNPACKING AND TRANSPORTATION INSTRUCTIONS 16
- Field Installation and Packing Instructions 16
- Set-Up for Field Operation 17
- Set-Up for Operation While Being Transported 17
- Packing Equipment for Storage 17

IV. OPERATING INSTRUCTIONS 18
- Preliminary 18
- Fixed Location Operation 18
  - Preliminary 19
  - Receiver Adjustment 19
  - Transmitter Adjustment 20
- Calibration Checking 20
- Recalibration after Changing Tubes 20
  - (1) Receiver Recalibration Procedure 20
  - (2) Transmitter Recalibration Procedure 21
- Field Calibration Check Before Tuning 21
  - (1) Receiver Calibration Check 21
  - (2) Transmitter Calibration Check 21
- Operation While Being Transported on a Man's Back 22
  - (1) Receiver Operation 22

TABLE OF CONTENTS—Continued

		Page
	(2) Transmitter Operation	22
	(3) Transmitter and Receiver Unit Operation with Reduced Antenna Length	22
	General Operating Instructions	22
V.	MAINTENANCE	23
	Routine Inspection	23
	1. Transmitter-Receiver Unit, Navy Type CRI-43044	23
	Check for Looseness and Wear	23
	Cleaning and Adjusting	23
	2. Antenna, Navy Type CWN-66087 or CWN-66087-S	24
	3. Battery, Navy Type CNC-19018B	24
	4. Microphone-Headphone Assembly, Navy Type CTE-51022B or CTE-51022C	24
	5. Key, Cord and Plug Assembly, Navy Type CRH-26013B	24
	Replacements	24
	Lubrication	24
VI.	SERVICING INSTRUCTIONS	25
	Location of Troubles	25
	Insufficient Distance Range	25
	Fading or Poor Signal Quality	25
	Signals Off Frequency	25
	Transmitter Does Not Load	25
	Transmitter Does Not Draw Plate Current	26
	Transmitter Loads Properly But Does not Modulate on Phone	26
	Transmitter Loads Properly But Does not Modulate on MCW	26
	MCW Operation Produces Unnatural Audio Frequency	26
	Receiver Does Not Super-Regenerate	26
	Lack of Sensitivity in Receiver	27
	Receiver Completely Dead	27
	Extremely Strong Side Tone on MCW	27
	Crystal Calibrator Does Not Oscillate	27
	Crystal Functions for Receiver Calibration but Not for Transmitter	27
	Instructions for Servicing the Equipment	27
	General Servicing Instructions	28
	(1) Indicating Meter M1 Check	28
	Transmitter Adjustments	28
	(1) Calibration and Realignment	28
	(2) Power Output Check	29
	Receiver Adjustments	29
	(1) Calibration and Realignment	29
	(2) Realignment Procedure	29
	(3) Sensitivity Adjustment	29
	Circuit Checking Data	30
	(1) Tube Contact Voltages	30
	(2) Point-to-Point Resistance Measurements	30
	(3) Current Measurements	31
VII.	TABLES	
	TABLE I—List of Major Units with Applicable Type Numbers for Model TBY-8 Radio Transmitting-Receiving Equipment	33
	TABLE II—Parts List by Symbol Designation for Model TBY-8 Radio Transmitting-Receiving Equipment	34
	TABLE III—Parts List by Navy Type Numbers for Model TBY-8 Radio Transmitting-Receiving Equipment	42
	TABLE IV—Spare Parts List by Navy Type Numbers for Model TBY-8 Transmitting-Receiving Equipment	43
	TABLE V—Applicable Color Codes and Miscellaneous Data for Model TBY-8 Transmitting-Receiving Equipment	48
	TABLE VI—Index to Manufacturers	49
VIII.	ILLUSTRATIONS AND DRAWINGS	50

LIST OF ILLUSTRATIONS AND DRAWINGS

Fig.	Title	Page
1	Navy Model TBY-8 Equipment Composite View	50
2	Transmitter-Receiver Unit, Navy Type CRI-43044, Front View	51
3	Transmitter-Receiver Unit, Navy Type CRI-43044, Chassis Removed from Case, Bottom View	52
4	Transmitter-Receiver Unit, Navy Type CRI-43044, Chassis Removed from Case, Rear from Right Side	53
5	Transmitter-Receiver Unit, Navy Type CRI-43044, Chassis Removed from Case, Rear from Left Side	54
6	Transmitter-Receiver Unit, Navy Type CRI-43044, Chassis Removed from Case, Top View	55
7	Navy Model TBY-8 Equipment Assembled for Field Operation	56
8	Navy Model TBY-8 Equipment Assembled for Operation on a Man's Back	57
9	Navy Model TBY-8 Equipment Packed in Shipping Chest, Navy Type CFG-10197, Cover Open	58
10	Schematic Diagram, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52513	59
11	Wiring Diagram, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52003	60
12	Outline Drawing, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52682	61
13	Outline Drawing and Wiring Diagram, Headphone and Microphone Assembly, Navy Type CTE-51022B or CTE-51022C, Drawing 52702	62
14	Outline Drawing and Wiring Diagram, Key, Cord and Plug Assembly, Navy Type CRH-26013B, Drawing P-7708922	63
15	Outline Drawing, Antenna, Navy Type CWN-66087 or CWN-66087-S, Drawing 51930	64
16	Outline Drawing, Circuit and Rating of Battery Pack, Navy Type CNC-19018B, Drawing 52053	65
17	Outline Drawing, Canvas Carrying Case, Navy Type CSS-10039B, Drawing 51957	66
18	Outline Drawing, Shipping Chest, Navy Type CFG-10197, Drawing 52061	67
19	Typical Tuning Data	68

GUARANTEE

The equipment including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided that such guarantee will not obligate the contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the contractor's design or is of a design selected by the contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design such item will be conclusively presumed to be of defective design and subject to one hundred per cent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any such defects, and any items repaired or replaced by the contractor will be guaranteed anew under this provision.

The provisions of the Navy standard "1 year service, replacement, on failure report radio guarantee" with respect to the design of the equipments, including all parts and spare parts, shall not be construed as applying to those component parts not of contractor's design and which the Navy Department requires shall be used in and made a part of the equipment, but instead shall be construed as applying only to such component parts designed or selected by the contractor and deemed by him as suitable in all respects for the purposes intended and as conforming fully to the requirements of the governing specifications. In case of reasonable doubt on the part of the contractor that any component, whether or not designed by the contractor, is not suitable for the purpose intended or does not conform to the requirements of the governing specifications, the contractor shall present full details to the Bureau of Ships for consideration and for approval as to the use of such components so that the equipments as manufactured and offered for acceptance by the contractor can be expected to meet the requirements of the specifications and be covered by the provisions of the contractual guarantee in spirit and intent, except to such extent as shall have been specifically authorized by the Bureau of Ships.

INSTRUCTIONS TO OPERATING PERSONNEL REGARDING REPORTS OF FAILURES

Report of failure of any part of this equipment, during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 31 (mimeographed form) of the Manual of Engineering Instructions, or Bureau of Ships Radio and Sound Bulletin Number 7, dated July 1, 1942, or superseding instructions.

Contract NXsr-37799 Date of Contract September 29, 1943

Serial number of equipment.....

Date of Acceptance by the Navy .....

Date of delivery to contract destination .....

Date of completion of installation.....

Date placed in service.....

Blank spaces in this book shall be filled in at time of installation. Operating personnel shall also mark the "date placed in service" on the date plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

All requests or requisitions for replacement material should include complete descriptive data covering the part desired, in the following form:

1. Name of part desired.
2. Navy Type number (if assigned) (including prefix and suffix as applicable).
3. Model designation (including suffix) of equipment in which used.
4. Navy Type designation (including prefix and suffix where applicable) of major unit in which part is used.
5. Symbol designation of part.
6. (a) Navy Drawing Number.
   (b) Manufacturer's Drawing Number.
7. Rating or other descriptive data.
8. Commercial designation.

RESTRICTED

Instruction Book
For
Navy Model TBY-8
Ultra-Portable Very-High Frequency
Transmitting-Receiving Equipment

1. INTRODUCTION

INTENT OF DESIGN

1-1. The Navy Model TBY-8 Equipment is a very-high frequency transmitter-receiver of the ultra-portable or pack type. The equipment provides two-way communication by either Voice (Telephone) or MCW Telegraphy on any one of 131 different channels in four bands with a frequency range of 28 to 80 megacycles. The equipment is supplied complete, including battery power supply and antenna and can be set up for operation in a minimum of time. It is designed for carrying as a knapsack load and can be operated by one man while it is mounted on his back.

LIST OF UNITS

1-2. The Navy Model TBY-8 Equipment consists of the following items:

1 Shipping Chest, Navy Type CFG-10197
1 Canvas Carrying Case, Navy Type CSS-10039B
1 Battery Pack, Navy Type CNC-19018B
1 Key, Cord and Plug Assembly, Navy Type CRH-26013B
1 Transmitter-Receiver Unit, Navy Type CRI-43044, including complete set of Vacuum Tubes consisting of:

Type	*Function*
1 Navy Type-30	Audio Amplifier
1 Navy Type-30	Crystal Oscillator
1 Navy Type-1E7G	Modulator
2 Navy Type-958A	Transmitter
1 Navy Type-958A	Receiver Detector
1 Navy Type-959	Receiver R.F. Amplifier
1 Navy Type-1E7G	Spare Tube
1 Navy Type-958A	Spare Tube
1 Navy Type-959	Spare Tube

2 Headphone and Microphone Assemblies, Navy Type CTE-51022B or CTE-51022C
1 Antenna, Navy Type CWN-66087 or CWN-66087-S
1 Set of Mobile Spare Parts consisting of:
  1 Antenna, Navy Type CWN-66087 or CWN-66087-S
  2 Battery Packs, Navy Type CNC-19018B
  1 Set Spare Vacuum Tubes, consisting of:
    2 Navy Type-30
    1 Navy Type-1E7G
    3 Navy Type-958A
    1 Navy Type-959
  1 Set of Tuning Charts
2 Instruction Books
1 Test Data Book
2 Keys for Shipping Chest Lock
Stock Spare Parts as listed in Table IV, pages 43 through 47.

DESCRIPTION—MECHANICAL

1-3. The Transmitter-Receiver Unit, Navy Type CRI-43044 is housed in a lightweight aluminum case to the bottom of which the battery power supply is strapped. The case top cover has a strap handle to facilitate handling when the unit is out of its canvas carrying case. The top cover is hinged and held in place by two snap catches to permit easy opening. All operating controls are located on a recessed front panel. An antenna mount on the left side of the case supports the detachable antenna. (See Fig. 7, page 56 and Fig. 12, Dwg. 52682 page 61). The mount permits 90° backward deflection of the Antenna, and by means of a friction device provides for holding the position of the Antenna at a desired angle. A receptacle, Navy Type CPH-49194, above the antenna mount provides for connection of a separate antenna by means of a concentric line. The Transmitter-Receiver Unit has provision for carrying one spare vacuum tube of each type, as listed in paragraph 1-2. The crystal oscillator tube, V5, Navy Type-30 may be used in an emergency as a spare for the audio amplifier tube, V6.

1-4. The Antenna, Navy Type CWN-66087 or CWN-66087-S consists of nine sections of light

weight seamless tubing and a spring base section. The Antenna when assembled forms a "fishpole" type Antenna approximately nine feet long (See Fig. 1, page 50 and Fig. 15, Dwg. 51930).

1-5. The Microphone-Headphone Assembly, Navy Type CTE-51022B or CTE-51022C, consists of an aircraft type anti-noise microphone and a special lightweight headphone assembly. These are connected to a 7-foot cable terminated by a plug for making connection to the Transmitter-Receiver Unit. The microphone is equipped with a "Press-to-Talk" switch which transfers the Transmitter-Receiver Unit circuits from the "receive" position to the "transmit" position when pressed. (See Fig. 1, Page 50 and Fig. 13, Dwg. 52702, Page 62).

1-6. The Key, Cord and Plug Assembly, Navy Type CRH-26013B, consists of a small aluminum housing containing a specially designed key and a send-receive switch. These are connected by means of a 4 foot cable to a suitable plug. The unit is protected by a flexible rubber cap and inner gasket to permit operation in rain when necessary. (See Fig. 1, Page 50 and Fig. 14, Dwg. P-7708922, Page 63).

1-7. The Battery Pack, Navy Type CNC-19018B straps in place on the under side of the Transmitter-Receiver Unit. A built-in receptacle automatically makes electrical connection to the Transmitter-Receiver Unit when the battery is installed, thereby facilitating rapid change of batteries. The battery is encased in a lightweight metal container that protects it from damage even if set in water or other foreign matter up to a depth of approximately two inches. (See Fig. 16, Dwg. 52053, Page 65).

1-8. The Canvas Carrying Case, Navy Type CSS-10039B, has a compartment at the top for storage of the two Microphone-Headphone Assemblies and the Key, Cord and Plug Assembly. A compartment at the right side of this case contains the ten antenna sections when disassembled for transportation. The main compartment, which houses the Transmitter-Receiver Unit, and the compartment for holding the Microphone-Headphone Assemblies and the Key, Cord and Plug Assembly are provided with Zipper fasteners to afford quick opening or closing of the compartments. The compartment which houses the ten (10) antenna sections is provided with a flap which is secured by means of a snap fastener. (See Fig. 1, Page 50, Fig. 8, Page 57 and Fig. 17, Dwg. 51957, Page 66).

1-9. For storage or shipping, the complete equipment including mobile spare parts (see paragraph 1-2) may be packed in the Shipping Chest, Navy Type CFG-10197. This chest is constructed of fibre covered wood and is provided with a hinged cover that may be locked by means of an attached standard Navy lock. The interior of the chest is divided into compartments that keep the units in proper position.

SPECIAL FEATURES

1-10. The equipment is so designed that two Microphone-Headphone Assemblies may be used simultaneously when necessary. Two complete Microphone-Headphone Assemblies, Navy Type CTE-51022B or CTE-51022C are supplied for this purpose and duplicate connections are provided on the front panel of the Transmitter-Receiver Unit to accommodate both sets. Either operator may control transmission, with reception being had by both simultaneously. Control of transmission may be transferred from one operator to the other at will. Operating control markings are of radioactive and phosphorescent inks, to facilitate operation in darkness.

LIST OF COMPONENTS WITH WEIGHTS AND DIMENSIONS

1-11. The following is a list of the major items supplied as a part of the Navy Model TBY-8 Equipment.

Transmitter-Receiver Unit, Navy Type CRI-43044 (Including Battery)
Height—12-3/32 inches
Width—11⅞ inches
Depth—7¼ inches
Weight 33.7 lbs. (Less Antenna but including tubes)

Battery, Navy Type CNC-19018B
Height—4¼ inches
Width—9⅜ inches
Depth—6-9/16 inches
Weight—13 lbs. approx.

Antenna, Navy Type CWN-66087 or CWN-66087-S
Consists of a spring base section and nine additional sections all of which are approximately 12 inches long.
Maximum diameter of spring base—1 11/32 in.
Maximum diameter of tubing—⅜ in.
Total length Assembled—9 feet.
Weight—1 lb.

Canvas Carrying Case, Navy Type CSS-10039B
Height—16½ inches
Width—12½ inches
Depth—8 inches
Weight—(Unpacked)—3½ lbs.

Key, Cord and Plug Assembly, Navy Type CRH-26013B

Key, less Cord and Plug
Height—1-13/16 inches
Width—1¾ inches
Length—2-51/64 inches
Weight with 4 foot Cord, and Plug—½ lb.

Microphone-Headphone Assembly, Navy Type CTE-51022B or CTE-51022C

Weight (Assembly complete with 7 foot cord and plug)—1.25 lb.
Microphone only—Navy Type CTE-51004B 1⅝ inches high by 2-3/32 inches diameter—Weight 0.25 lb.
Headphone assembly only—Navy Type CTE-49015—Weight 0.5 lb.

Shipping Chest, Navy Type CFG-10197

Height—11⅞ inches
Width—22⅝ inches
Depth—18 inches
Weight (Unpacked)—22½ lbs.

TOTAL WEIGHT OF MODEL TBY EQUIPMENT PACKED IN SHIPPING CHEST.
90 lbs. Approx.

II. DETAILED DESCRIPTION

TRANSMITTER-RECEIVER UNIT

Schematic Diagram—Fig. 10—Dwg. 52513, Page 59
Wiring Diagram—Fig. 11—Dwg. 52003, Page 60
Outline Drawing—Fig. 12—Dwg. 52682, Page 61
Photographs—Figs. 2 through 6, Pages 51 through 55

MECHANICAL

2-1. The Transmitter-Receiver Unit, Navy Type CRI-43044 is contained in a case made of 1/16″ thick aluminum assembled by spot-welding and reinforced by ridges pressed into the metal. The top of the case is made in the form of a cover which is hinged to afford easy access to the interior of the unit. This cover is held in place by two (2) snap catches. A handle on the top cover facilitates transportation of the equipment when removed from the canvas carrying case. A bent up angle frame is spot-welded to the bottom of the case to reinforce it and to position the battery properly. Two straps hold the battery in place. All external surfaces of the case are finished with an olive green wrinkle lacquer. The front panel and the battery are finished in a plain flat olive green that matches the color of the case.

2-2. The calibration charts for the unit are located on the top cover. The front right-hand portion of the cover has suitable catches for mounting the Key, Cord and Plug Assembly, Navy Type CRH-26013B, when desired.

2-3. The components of the Transmitter-Receiver Unit are mounted on an aluminum front panel and sub-chassis, formed and welded to produce a rigid, lightweight assembly. A name-plate completely covers the front panel and bears the designations for all of the controls. The chassis is removable from the case proper by opening the top cover, removing nine screws and removing the connection to the concentric line connector. With the chassis removed from the case all electrical circuits and parts are completely exposed. (See Fig. 3, 4, 5 and 6, Pages 52, 53, 54, and 55).

2-4. The internal construction is made up essentially of two assemblies, the Transmitter Assembly and the Receiver Assembly, both mounted on the chassis. These two Assemblies contain the necessary radio frequency circuits, coils, capacitors, vacuum tubes, etc. Each of these components is designated by a symbol suitably marked on the component or adjacent to it on the chassis.

2-5. In each assembly there is a band changing mechanism consisting of a coil turret that allows selection of the proper coil for the band. These coils are wound with solid silver enameled wire. Paragraph 5-1 contains information for the maintenance of the enamel covered wire. Further information on the actual operation of the turret assemblies is given in paragraphs 2-8 to 2-10.

2-6. The Antenna, Navy Type CWN-66087 or CWN-66087-S is in ten sections that fit together by means of ferrules to form an Antenna 9 feet in length. The end of each section is color coded to indicate the proper order of assembly. All sections of the Antenna are finished in olive green wrinkle lacquer. The length and diameter of the sections, apart from the spring base, differ to provide proper flexibility. The spring base section contains a spring which allows the Antenna as a whole to bend up to 90 degrees in any direction from its original position should the Antenna strike an obstacle. The end of the base section is threaded to provide for fastening to the Transmitter-Receiver Antenna deflecting mechanism. This mechanism holds the Antenna in an

upright or horizontal position or at any intermediate angle. Fig. 15, Dwg. 51930, Page 64 shows the general construction of the Antenna sections. Fig. 7, Page 56, shows the Antenna assembled for field operation.

ELECTRICAL CIRCUITS

2-7. The circuits of the Transmitter-Receiver Unit consist of four distinct groups:

(1) Transmitter R.F. Section
(2) Receiver R.F. Section
(3) Audio Amplifier Section
(4) Crystal Calibrator Section

These sections are inter-connected by means of the operating controls and the send-receive relay K1, to perform the following functions:

(1) Telephone Transmission
(2) MCW Transmission
(3) Telephone or MCW Reception
(4) Transmitter Calibration
(5) Receiver Calibration

TRANSMITTER—R.F. SECTION

2-8. The Transmitter R.F. section consists of a conventional "Hartley" push-pull self-excited oscillator circuit using two acorn triode vacuum tubes V3 and V4, Navy Type-958A. The tank or tuning circuit for this oscillator consists of tuning capacitor C14 and tuning inductance L7, L8, L9, or L17, depending on the position of the TRANS. BAND selector control. The frequency range of the transmitter (28 to 80 Mcs.) is divided into four bands. The four inductances L7, L8, L9 and L17 are mounted on a rotating turret assembly which is controlled by the TRANS. BAND selector knob on the front panel. As this control is rotated the proper inductance for the band desired is brought into position and spring contacts automatically make the electrical connections between the inductance and the rest of the circuit. The spring contacts that make connections to the inductances are designated as S3 on the schematic diagram Fig. 10, Dwg. 52513, Page 59. Plate power is applied to the transmitter tubes by series feed through a center-tap on the tuning inductance L7, L8, L9 or L17. A plate voltage dropping resistor R3 is inserted in the plate supply lead between L7, L8, L9 or L17 and the power source. Bypass capacitor C18 prevents R.F. power from entering the audio and power supply circuits. The grid circuit of the transmitter consists of grid choke L10, bypass capacitor C17 and grid resistor R4 which, through grid leak action, provides the necessary operating bias voltage. The control grids of the two transmitter tubes V3 and V4 obtain proper operating R.F. voltage by connection through grid coupling capacitors C15 and C16 to proper taps on the tuning inductance L7, L8, L9 or L17. The Antenna, Navy Type CWN-66087 or CWN-66087-S is inductively coupled to the transmitter and is tuned by capacitor C13. Capacitor C13 is controlled by the front panel control designated TRANS. ANT. LOADING.

RECEIVER—R.F. SECTION

2-9. The receiver R.F. section consists of a tuned R.F. amplifier using an acorn pentode tube V1, Navy Type-959, followed by a super-regenerative detector employing an acorn triode tube V2, Navy Type-958A. The tuned R.F. stage consists of vacuum tube V1, the grid circuit of which is tuned by capacitor C1 and inductances L1, L2, L3 or L15. As in the transmitter, the receiver frequency range (28 to 80 Mcs.) is divided into four bands and the desired band is selected by the RECEIVER BAND selector control which rotates the tuning inductance coils into the proper position. The antenna is inductively coupled to the R.F. stage by suitable fixed coupling coils which are a part of each of the tuning coil assemblies, L1, L2, L3 or L15. The capacitor C2 is a trimming capacitor connected across tuning capacitor C1 and allows the R.F. circuit to be adjusted to exact resonance by compensating for varying antenna conditions. Trimming capacitor C2 is adjustable from the front panel and is designated as REC. ANT. TUNING. This control provides adjustment to compensate for different lengths of antenna which may be used, or for changes in antenna characteristics due to proximity of surrounding objects. The plate circuit of the R.F. amplifier is inductively coupled to the tuned circuit of the super-regenerative detector. Plate and screen grid power is supplied to this R.F. stage through the R.F. filter composed of choke coil L11 and bypass capacitors C10 and C30. Resistor R1 is the screen grid dropping resistor and capacitor C4 the screen grid bypass capacitor. The R.F. stage grid return circuit is bypassed by capacitor C3 and terminates at the bias potentiometer composed of R21 and R22 which provide the proper operating bias voltage for the R.F. stage.

SUPER-REGENERATIVE DETECTOR

2-10. The super-regenerative detector is tuned to resonance by tuning capacitor C6 and tuning inductance L4, L5, L6 or L16. The four tuning inductances, L4, L5, L6 and L16 are of the proper value to permit the detector tuning to be the same as that of the R.F. stage. The

R.F. tuning capacitor C1 and the detector tuning capacitor C6 are ganged together and controlled from the front panel by the main tuning control for the receiver (RECEIVER TUNING). Similarly, the four tuning inductances of the R.F. stage L1, L2, L3 and L15 and the four tuning inductances of the detector L4, L5, L6 and L16 are each mounted on turret assemblies similar to that used for the transmitter and these two assemblies are ganged together for simultaneous operation from the front panel by the RECEIVER BAND selector control. Each coil assembly is equipped with the proper number of contacts to connect the desired set of coils to the rest of the R.F. circuits. The contact arrangement for the R.F. stage tuning coils is designated on the schematic diagram as S1 while that of the detector is designated as S2. The detector tuning inductances L4, L5, L6 and L16 are tapped at the proper point to provide grid and plate voltages approximately 180 degrees out of phase to produce oscillation. The grid of the detector tube is coupled to the tuned circuit by grid capacitor C7. The plate of the detector tube is returned to the opposite end of the tuned circuit from that to which the grid is coupled. The grid leak resistor R2 is connected directly between grid and plate of the detector and the combination of grid resistor value, grid capacitor value and degree of regeneration is such that proper super-regenerative action is obtained throughout the frequency range of the equipment. The plate and filament supply circuits are filtered by choke coil L12 and bypass capacitor C11, and choke coil L13 and bypass capacitor C12 respectively. These filter systems minimize the amount of R.F. from the detector entering the audio or battery power circuits. The R.F. filter choke coils L11, L12 and L13 and their associated bypass capacitors are enclosed in a separate shield to complete their effectiveness. This shielded compartment is located directly below the detector circuits on the under side of the chassis. The complete detector circuit is also completely shielded from the R.F. amplifier stage and other circuits in the equipment. This compartment has a cover which, when removed, allows access to the detector tube for replacement and inspection of the detector R.F. circuits.

AUDIO AMPLIFIER SECTION

2-11. The audio amplifier section serves the transmitter, receiver and the crystal calibrator. It consists of a Navy Type-30 low level audio amplifier tube V6 (or audio oscillator) and a Navy Type-1E7G high level audio amplifier or modulator tube V7. The audio tubes serve as follows under the indicated conditions of operation.

2-12. **Voice Transmission** — Under voice transmission condition the Navy Type-30 low level audio tube V6 is not used, although plate and filament voltages are not removed from this tube. The Navy Type-1E7G tube V7 is used as the modulator for supplying audio power to the transmitter. This tube is of the twin pentode type operating in a Class AB1 push-pull circuit taking power from the microphone and amplifying it to the proper level to produce at least 70% modulation of the transmitter for phone (VOICE) transmission. The microphone is connected to the primary winding between terminals 3 and 4 (microphone winding) on transformer T2. The secondary winding of Transformer T2 is split to provide proper excitation for the two control grids of the Navy Type-1E7G tube V7 operating push-pull. The secondary winding between terminals 6 and 7 of the output transformer T3 is connected in series with the plate supply lead for plate modulation of the transmitter-oscillator. A second low voltage secondary winding (terminals 4 and 5) on transformer T3 is connected to the headphones to give audio side tone during transmission. Resistor R16 is placed in series with the headphones during transmission to prevent excessive loading of the modulator by the headphones, and to limit the side tone signal to a reasonable headphone volume.

2-13. **MCW Transmission**—Under MCW transmission condition the Navy Type-30 audio tube is made to operate as a tone generator. The grid circuit of this tube is composed of the input transformer T1 and the audio volume control R7. The plate circuit consists of the primary winding (terminals 1 and 2) of interstage transformer T2. A feedback circuit is provided to allow this tube to oscillate as a tone generator when MCW transmission is desired. The feedback is supplied by capacitor C25 and resistors R12 and R13 connected from plate to ground. The audio voltage drop across resistor R13 is fed back to a special feedback winding (terminals 5 and 6) on the input transformer T1. The feedback circuit is completed by returning the feedback winding on input transformer T1 to ground through the telegraph key. Thus, whenever the key is closed the feedback circuit is complete and the Navy Type-30 tube oscillates as a tone generator, the output of which is amplified by the Navy Type-1E7G tube and modulates the transmitter output. The frequency of the tone generator is controlled by the value of capacitor C24 which tunes the feedback winding on the input trans-

former T1 to the desired audio frequency. The contacts "C" on the transfer relay K1 short out the volume control R7 during transmission so that this control has no effect.

2-14. **Reception**—The audio output of the receiver detector is coupled to the grid of the Navy Type-30 low level amplifier tube through the primary winding (terminals 1 and 2) on the input transformer T1. The Navy Type-30 tube, under this condition, functions as a normal amplifier with the volume control R7 controlling the level desired. The audio output of the receiver detector is therefore amplified by both audio stages and is supplied to the headphones by the headphone winding (Terminals 4 and 5) on the output transformer T3. The transfer relay K1, when in the "receive" position, shorts out resistor R16 by means of contacts "B" and allows full output of the audio system to be applied to the headphones.

2-15. **Audio Circuits, General**—The capacitors C26 and C27 are connected from plate to ground in the output audio stage and capacitor C22 is connected from grid to ground in the low level audio stage to reduce the high frequency audio response of the audio system. Reduction of the higher audio frequencies eliminates considerable background noise during transmission or reception without affecting the quality of voice or MCW communication. Microphone power is obtained from the 7.5 volt section of the battery normally used for bias supply. Resistor R11 is placed in series with the microphone circuit to limit the microphone current to a normal value. The receiver regeneration is controlled by resistor R8 which allows variation of the detector plate voltage. Resistor R10, connected in series with resistor R8, is a fixed detector plate dropping resistor which prevents excessive voltage from being applied to the detector tube.

CRYSTAL CALIBRATOR SECTION

2-16. **Calibration, General**—A 5000 Kcs. crystal oscillator is provided in the equipment to furnish calibrating points every 12½ channels throughout the frequency range of the equipment. Harmonics of the 5000 Kcs. oscillator provide these check points and the methods by which these harmonics are used differ for transmission and reception as explained below. The oscillator circuit utilizes a Navy Type-30 tube, V5, in a standard fixed tuned crystal circuit. The crystal Y1 and grid leak R5 constitute the grid circuit of the oscillator and the plate circuit is made up of the fixed tuned circuit inductance L14 and capacitor C19 and plate dropping resistor R6. The oscillator is coupled to the receiver portion of the equipment through capacitor C20 which is connected to the audio input circuit. A crystal calibrator switch S4 is provided on the front panel of the Transmitter-Receiver Unit to control the use of this oscillator.

2-17. **Transmitter Calibration**—Under this condition a beat note is obtained in the headphones whenever the transmitter frequency is tuned through any one of the harmonic frequencies of the crystal calibrator. Due to stray coupling between the transmitter circuits and the crystal oscillator tube, the transmitter and crystal frequencies mix in the crystal oscillator (detector action) and the resultant audio frequency passes through the audio system and is heard in the headphones. The audio output of the crystal oscillator tube is coupled to the audio system input by capacitor C20. The audio system is operated as for reception but the side tone resistor R16 in series with the headphones during transmission is shorted out by means of contacts on the CRYSTAL — ON — OFF switch, in order to obtain full output in the headphones instead of the relatively weak side tone output.

2-18. **Receiver Calibration**—Under this condition the crystal calibrator radiates sufficient energy at its harmonics to cause a very marked reduction in the receiver superregenerative hiss-level, giving an accurate indication of receiver resonance. No beat note is heard in the phones when checking calibrated points on the receiver, since there is practically no radiation from the receiver into the crystal oscillator, and, therefore, very low audio output from the crystal oscillator circuit is obtained.

2-19. **Control Relay**—The normal de-energized position of the transfer or send-receive relay K1 is for reception. It is energized when the SEND-RECEIVE switch on the Key, Cord and Plug Assembly, Navy Type CRH-26013B, is placed at SEND or the "Push to Talk" button on the microphone is pressed. As the relay is energized it performs the following changes in the circuit:

(1) By means of contacts K1-F, the antenna is switched from receiver input to transmitter output.
(2) By means of contacts K1-E the plate supply of the Navy Type-958A transmitter tubes is applied. When the transfer relay is in the "receive" position, the plate supply is removed.
(3) By means of contacts K1-D, the filament power is switched from receiver tubes

V1 and V2 to transmitter tubes V3 and V4.

(4) By means of contacts K1-C, the volume control R7 is shorted out to permit the Navy Type-30 audio tube V6 to function as a tone generator on MCW transmission.

(5) By means of contact K1-B, the side tone resistor R16 is inserted in series with the headphones to provide side tone at a reasonable headphone level, and additionally, the receiver antenna circuit is grounded.

INDICATING METER

2-20. The meter M1, located on the front panel is used to indicate proper filament voltage setting for either the R.F. or audio tubes and to indicate transmitter plate current. The meter M1 is connected through a switch S5 and suitable resistors R17, R18 and R19 so as to indicate filament voltage of the R.F. tubes (normally 1.28 volts), filament voltage of the audio tubes (normally 2 volts) and the plate current of the transmitter tubes (normally 16 ma.), when the meter is at mid-scale. The scale of the meter is purely arbitrary, being 4 volts full scale in the audio filament position, 2.56 volts in the R.F. filament position and 32 milliamperes in the plate current position. Adjustment is, therefore, always made to the mid-scale point to insure proper operating conditions for the equipment. Filament rheostat R14 provides control of the audio tube filament voltage and rheostat R15 gives the same control of the R.F. tube filament voltage. Transmitter plate current is controlled by adjusting the antenna coupling capacitor C13 until mid-scale reading of the meter is obtained.

BATTERY—NAVY TYPE CNC-19018B

Outline and Circuit Drawing, Fig. 16, Dwg. 52053, Page 65.

2-21. The battery supplied is designed especially for use with the TBY Equipment. It fits snugly into position at the bottom of the Transmitter-Receiver Unit, Navy Type CRI-43044 and a built-in receptacle automatically makes connection through a corresponding plug in the bottom of the Transmitter-Receiver Unit. The battery is designed to withstand tropical conditions and is protected by a thin sheet-metal enclosure, plated and painted to match the appearance of the Transmitter-Receiver Unit. This metal enclosure protects the battery from damage due to normal handling, and in addition, produces a waterproof unit which permits operation of the equipment while standing in water or other foreign matter up to a depth of approximately two (2) inches. The internal connections of the battery sections to the connection socket are shown on Fig. 16, Dwg. 52053, Page 65.

BATTERY RATING AND PERFORMANCE

2-22. A new battery will show the following voltages as measured between the common terminal and the terminal indicated: (Refer to Fig. 16, Dwg. 52053, Page 65).

Terminal	Voltage
B	+156.0
A1	+3.0
A2	+1.5
C	—7.5

Within 30 days from the date of manufacture, the battery when used alternately, fifteen minutes for transmitter load and fifteen minutes for receiver load, for a 25-hour period, will produce a performance as regards voltage of not less than the following:

Terminal	Trans. Load	Rec. Load	Voltages Under Trans. Load at the End of 25 Hours
B	5200 ohms	9800 ohms	125.0 volts
A1	8 ohms	10 ohms	2.3 volts
A2	7.5 ohms	10 ohms	1.28 volts
C	375 ohms	Open Circuit	6.5 volts

At the end of 6 months from date of manufacture the battery performance as regards voltage will not be less than 15 hours when employed as per the description above.

KEY, CORD AND PLUG ASSEMBLY—NAVY TYPE CRH-26013B

Outline and Connection Drawing, Fig. 14, Dwg. P-7708922, Page 63.

2-23. The telegraph key assembly, supplied as part of the Model TBY-8 equipment, consists of a special light-weight unit designed especially for use with this equipment. A thin rubber cover enclosing the key assembly and an internal gasket make it suitable for operation in inclement weather. The key mechanism consists of a small plunger operating in a suitable bearing. One end of the plunger is fitted with a conventionally shaped operating knob and the other end constitutes the contact. A coil spring provides the necessary return of the key and is proportioned to permit accurate average speed keying. The mechanism is housed in a small aluminum box along with the SEND-RECEIVE switch of the toggle type. The bottom plate of the box is removable, by removing four screws, to allow access for cleaning and inspection. This plate extends beyond the box on two sides to form flanges for attaching to the top cover of the Transmitter-Receiver Unit by means of small spring catches. A four foot connection cable equipped with a suitable plug provides connection to the Transmitter-Receiver Unit. As can be seen from Fig. 14, Dwg. P-7708922,

Page 63, the complete assembly is small and lightweight, weighing, complete, approximately ½ pound. Fig. 14, Dwg. P-7708922, Page 63, also shows the electrical connections of the key, cord and cable. It will be noted on either Fig. 14, Dwg. P-7708922, Page 63, or on the schematic diagram Fig. 10, Dwg. 52513, Page 59, that the SEND-RECEIVE switch is of the double-pole, single-throw type with one pole connected in series with the key to prevent the key circuit from becoming accidentally closed when the equipment is being used for reception. It is, therefore, impossible to accidentally cause the low level audio tube V6, Navy Type-30, to operate as a tone generator and cause undesirable side tone signals in the headphones when operating the equipment in the "receive" position.

MICROPHONE-HEADPHONE ASSEMBLY—NAVY TYPE CTE-51022B or CTE-51022C

Outline and Connection Drawing, Fig. 13, Dwg. 52702, Page 62.

2-24. The Microphone-Headphone Assembly consists of a small lightweight aircraft type microphone and a special headset connected by a special cable to the connector plug. The Microphone, Navy Type-51004B, is a single button carbon type encased in a molded phenolic case. It is equipped with a "Press-to-Talk" button which, when not depressed, opens the microphone circuit and prevents current from flowing when the microphone is not in use. This precaution prevents excess drain on the battery and in addition prevents packing of the carbon in the microphone button due to excessive heat. The mouthpiece of the microphone is so designed that extraneous noises will not materially affect the microphone, thereby reducing background noise from this source to a minimum. The headphone set consists of two 300 ohm headphones, Navy Type CTE-49016, connected in series and assembled by means of a special lightweight cloth strap headband. The two receivers are equipped with ear cushions that permit the wearing of the headset for long periods of time without discomfort and at the same time exclude outside noises that might otherwise interfere with reception. The headset is also equipped with an adjustable chin strap to help hold the headset in place on the head and permits considerable activity by the operator without fear of having the headset dislodged. The headphone-microphone cord is specially constructed for this assembly. The length of cord available for each headphone and the microphone is sufficient to permit freedom of movement during operation. When not in use the microphone may be clipped to the operator's shirt pocket or to the ring on the chin strap. The electrical connections of this unit are shown in Fig. 13, Dwg. 52702, Page 62.

III. PACKING, UNPACKING AND TRANSPORTATION INSTRUCTIONS

FIELD INSTALLATION AND PACKING INSTRUCTIONS

3-1. The complete equipment supplied includes, in addition to the normal complement of items necessary for field operation, a set of mobile spare parts, instruction books and test data book as listed in paragraph 1-2. The items necessary for operation in the field are the Transmitter-Receiver Unit, Navy Type CRI-43044; one Antenna, Navy Type CWN-66087 or CWN-66087-S; one Key, Cord and Plug Assembly Navy Type CRH-26013B; two Microphone-Headphone Assemblies, Navy Type CTE-51022B or CTE-51022C; one Battery, Navy Type CNC-19018B; and one Canvas Carrying Case, Navy Type CSS-10039B. This field equipment is packed in the canvas carrying case for transportation on a man's back when in the field.

3-2. The Canvas Carrying Case, Navy Type CSS-10039B, is equipped with three compartments; one for the Transmitter-Receiver Unit with its battery attached, one for the two Microphone-Headphone Assemblies and the Key, Cord and Plug Assembly, and one for the antenna sections. By opening the two "Zipper" fasteners, the main flap on the case may be folded back permitting the Transmitter-Receiver Unit with its battery strapped in place to be put in the large main compartment of the case. The Transmitter-Receiver Unit should be positioned so that all controls on the front panel can be operated when the flap is folded back. After the Transmitter-Receiver Unit is in place the two main "Zippers" are to be closed. The cables of the two Microphone-Headphone Assemblies and the Key, Cord and Plug Assembly should be coiled so as to permit these units to be placed in the top compartment which is then closed by its "Zipper" fastener. The long compartment on the side of the canvas case is for storage of the ten antenna sections when not in use. The flap over this compartment should be secured by the snap catch after the antenna sections have been put in place. The canvas carrying case is now packed and can be placed on a man's back for adjustment of the shoulder straps to the proper length for ease in carrying. The two wide shoulder straps pass over the shoulders and under the arms

with the snap catches fastened to the two rings at the lower corners of the case. The two secondary straps should be adjusted in length so that they can be snapped on to the carrier's regulation pistol belt. These two straps should run practically straight down over the man's chest to his belt and should keep the shoulder straps from sliding off the shoulders. Once the straps have been adjusted the case can be placed on or removed from the man's back by manipulation of the catches on the two straps which fasten to the carrier's belt.

SET-UP FOR FIELD OPERATION

3-3. The first requirement for reliable communication is to select the most favorable spot available for setting up the equipment. The location should be as high above surrounding objects as possible. Best operation is obtained with as few obstructions, such as hills, steel buildings, etc., as possible in the direction of proposed transmission and reception. The operating personnel should, wherever possible, study the surroundings carefully and select an operating point which will conform to the above general requirements as nearly as possible.

3-4. After a suitable location has been selected the equipment should be set up for operation in the following manner. Remove the Transmitter-Receiver Unit from the canvas case and the antenna sections from their compartment. Assemble the proper number of antenna sections together as indicated in the calibration charts and fit the antenna in place on the Transmitter-Receiver unit. Adjust the Antenna to the desired angle as provided for by the Antenna deflecting mechanism. This may be conveniently done by grasping the spring base section and applying sufficient pressure to rotate the mechanism. Friction in the mechanism is such that the Antenna will be held at the angle at which it is set. A plug-in receptacle above the antenna mechanism provides for connection of an external antenna through a concentric line. Connect the Key, Cord and Plug Assembly and one or both of the Microphone-Headphone Assemblies as needed. The connector plugs should be seated properly in their receptacles in the front panel and the lock nuts on the plugs drawn up tight to insure proper connection. The equipment is now ready for tuning adjustments in accordance with Section IV and selection of final operating locations as explained in paragraph 3-5.

3-5. Before tuning the equipment the Transmitter-Receiver Unit should be placed in the exact location from which operation is to be carried on. This procedure, although not absolutely necessary, will insure maximum operating efficiency by having the equipment tuned under actual operating conditions. This exact location should be selected carefully. There should be no large metal objects such as power lines, steel towers, or buildings, water tanks, etc., near the antenna as such objects materially reduce the effectiveness of the equipment. When in open country, the best location for the equipment is directly on the ground on top of a hill. In congested areas height above ground will be an advantage.

SET-UP FOR OPERATION WHILE BEING TRANSPORTED

3-6. The equipment may be used for communication while being transported on a man's back. In this case the Transmitter-Receiver Unit is not removed from the canvas carrying case. The Key, Cord and Plug Assembly and one Microphone-Headphone Assembly are connected as described in paragraph 3-4 and the antenna is connected to the Transmitter-Receiver Unit by opening the flap cover of the small compartment on the side of the carrying case and connecting the antenna through the opening. The Antenna may be adjusted to the desired angle while the Transmitter-Receiver unit is in the carrying case as described in paragraph 3-4. The Key-Microphone-Headphone compartment of the Carrying Case should be closed and the "Zipper" fasteners on the main cover flap closed as far as possible with the Key and Microphone-Headphone Assembly cables protruding through the opening at the bottom of the flap. (See Fig. 8, Page 57). With the unit mounted on a man's back the headphone can be held in place by means of the chin strap and the hands are left free to manipulate either the microphone or the key. The key, in this case, can be held in one hand, and keying done with the other hand, or it can be clipped to the belt and keyed from that position. When using the equipment in this manner, follow the tuning procedure outlined in paragraph 4-6.

PACKING EQUIPMENT FOR STORAGE

3-7. For storage or shipping purposes, the complete equipment is to be packed in the Shipping Chest, Navy Type CFG-10197, provided for this purpose. The equipment which this chest is capable of accommodating is as follows:

1 Canvas Carrying Case, Navy Type CSS-10039B
1 Battery Pack, Navy Type CNC-19018B
1 Key, Cord and Plug Assembly, Navy Type CRH-26013B.

1 Transmitter-Receiver Unit, Navy Type CRI-43044
2 Headphone and Microphone Assemblies, Navy Type CTE-51022B or CTE-51022C
1 Antenna, Navy Type CWN-66087 or CWN-66087-S
1 Set of Mobile Spare Parts consisting of:
  1 Antenna, Navy Type CWN-66087 or CWN-66087-S
  2 Battery Packs, Navy Type CNC-19018B
  1 Set Spare Vacuum Tubes consisting of:
    2 Navy Type-30
    1 Navy Type-1E7G
    3 Navy Type-958A
    1 Navy Type-959
  1 Set of Tuning Charts
2 Instruction Books
1 Test Data Book
2 Keys for Shipping Chest Lock

3-8. The Transmitter-Receiver Unit, Navy Type CRI-43044, is to be packed in the shipping chest after it has been placed in its Canvas Carrying Case, Navy Type CSS-10039B. All vacuum tubes are to be left in the Transmitter-Receiver Unit when it is packed. The Battery, Navy Type CNC-19018B, must be removed from the Transmitter-Receiver Unit before this unit is placed in the canvas carrying case and then in the shipping chest. The battery is to be packed separately along with the two spare batteries in the compartment provided for this purpose. After placing the Transmitter-Receiver Unit, less its battery in the canvas carrying case, compress the lower part of the canvas case (volume normally occupied by the battery) a sufficient amount to permit sliding the Transmitter-Receiver Unit and canvas case into the right hand compartment of the shipping chest. The antenna sections are to be left in their compartment in the canvas case and the unit put in the right hand compartment of the shipping chest with the top of the Transmitter-Receiver Unit facing the front of the chest and the front panel facing the top of the chest. Positioning brackets are provided in the corners of this compartment to maintain the Transmitter-Receiver Unit in this position in the chest during handling.

3-9. The two spare batteries, Navy Type CNC-19018B and the battery removed from the Transmitter-Receiver Unit are to be placed in the left-hand compartment. These batteries are to be packed in their cardboard shipping cartons to protect and hold them in place during handling. For this reason, when removing a battery for use do not throw the cardboard carton away as it will be needed again when the battery is again stored in the chest. Remove the battery to be used and then replace the empty carton for further use.

3-10. When shipped from the factory two instruction books, one set of tuning charts, and the test data book are placed in an envelope and packed in the shipping chest in the space between the Transmitter-Receiver Unit and the top of the chest.

3-11. The spare vacuum tubes are the final items to be packed in the shipping chest. These tubes (in their original packing cartons) are stored in the compartment on the under side of the chest cover. (See Fig. 9, Page 58). The three audio tubes (two Navy Type-30 and one Navy Type-1E7G) occupy the left section of this compartment. The four R.F. tubes (three Navy Type-958A and one Navy Type-959) occupy the right section. When a spare tube is removed for use it is well to return the empty carton to its place so that all tubes will remain in their proper positions during handling.

3-12. With all the equipment packed in the shipping chest, the cover should be closed and locked. When handling or storing the equipment see that the top of the chest is up at all times to minimize the chance of damage by movement of the units in the chest or the possibility of the cover accidentally opening.

IV. OPERATING INSTRUCTIONS

PRELIMINARY

4-1. The frequency range of the equipment is 28 to 80 megacycles and throughout this range the equipment is calibrated for operation on any one of 131 channels separated from each other by 400 Kc. The calibration charts on the top cover of the Transmitter-Receiver Unit give the dial settings and number of antenna sections to be used for each of these channels. The channels are numbered from 1 through 131, with No. 1 channel being the 28 megacycle point and No. 131 the 80 megacycle point. No reference to frequency is made on the calibration chart as all data are listed according to the channel number. Operations should, therefore, always be conducted on channel assignments rather than frequency assignments. Typical tuning data, Fig. 19, Page 68, lists channels against frequency and may be referred to for purpose of becoming familiar with channel numbers and corresponding frequencies.

FIXED LOCATION OPERATION

4-2. If the equipment is to be operated at a fixed location the operating site should be selected

and the equipment set up for operation as described in Section III. The following procedure should then be followed to place the equipment in operation.

Preliminary

(1) Remove the antenna sections from their pocket in the side of the canvas case and assemble the number of sections indicated on the calibration charts for operation on the desired channel, starting with the spring base section which has a threaded end. Screw this section of the antenna into place in the antenna mount on the case.

(2) Remove the combination Microphone-Headphone Assemblies and Key, Cord and Plug Assembly, from the pocket at the top of the knapsack and plug them into the proper receptacles on the front panel of the set. The notches in the plug rim will position the plug properly after which it should be locked in place by means of the lock nut on the plug. When the equipment is to be operated by only one operator greater volume can be had by connecting only one Microphone-Headphone Assembly. The other assembly can be left in the compartment.

(3) Refer to the calibration charts on the top cover of the Transmitter-Receiver Unit and set the TRANS. BAND and RECEIVER BAND selector switches and tuning controls to the proper points for the desired channel.

(4) Turn the set ON by means of the dual POWER switch S6 and S9, making sure at the same time that the top cover is properly in place and secured by the snap catches on the sides of the Transmitter-Receiver Unit. Adjust the filament voltages to the proper values by setting the METER SWITCH S5 to the R.F. FIL. voltage point and adjusting rheostat R15 until the meter M1 indicates mid-scale reading as indicated by the mid-scale mark. Change the METER SWITCH S5 to the AUDIO FIL. voltage position and similarly adjust rheostat R14 so that the meter indicates to the mid-scale position. If the meter fails to come to the mid-scale point with rheostat R14 or R15 fully clockwise, the battery should be replaced.

Receiver Adjustment

(5) Adjust the VOLUME control to approximately its mid-position and advance the REGEN. control clockwise from its extreme left-hand position until a definite rushing or hissing sound is heard in the headphones. This sound indicates that the detector tube is super-regenerating and can be heard whenever there is no signal present. As the REGEN. control is advanced in a clockwise direction the super-regeneration noise will increase in strength. Preliminary adjustment should be made to a point where this noise is not objectionable to the ear.

(6) Adjust the REC. ANT. TUNING control to approximate resonance. In general, this control will resonate near its extreme clockwise position at the high frequency end of each band, near the midpoint position in the center of each band and near the extreme counterclockwise position at the low frequency end of each band. Approximate adjustment should be made by setting this control to a position governed by the portion of the band the operating channel occupies.

(7) Tune in the desired signal by slight readjustment of the RECEIVER TUNING control, if necessary. (See also Calibration Checking Paragraph 4-3). Exact tuning or resonance is indicated by minimum super-regenerative noise in the headphones. With the RECEIVER TUNING control adjusted in this manner make final adjustment of the REC. ANT. TUNING by adjusting this control for minimum super-regenerative noise. Final tuning adjustment is that setting of the REC. ANT. TUNING control and the RECEIVER TUNING control which produces minimum super-regenerative noise in the headphones.

(8) Final adjustment of the REGEN. control should now be made by setting the regeneration just above the point where super-regeneration starts. This setting normally produces maximum sensitivity of the receiver and should be used at all times except possibly when an extremely strong signal is being received. Under such a condition the regeneration control may be advanced in a clockwise direction a sufficient amount to eliminate distortion which may be present due to overloading of the detector tube. If a strong signal is being received it may be necessary to reduce the volume by turning the volume control in a counterclockwise direction at the same time.

(9) If two receivers are being operated on the same frequency in close proximity to each other, it may become necessary

to readjust the REGEN. control to avoid interference with reception. A small amount of energy from the oscillating detector tube is radiated from a receiver antenna; another receiver tuned to the same frequency and located in close proximity to the first receiver will pick up this energy. The receiver radiated energy is modulated with the super-regeneration interrupter frequency (approximately 30 Kc.) and this modulation will cause an interfering beat note to be heard in the second receiver. If such interference does exist, the REGEN. control should be adjusted until the interference is a high frequency tone where it will not interfere with normal reception.

Transmitter Adjustment

(10) Set the meter switch S5 to its mid-position (TRANS. PLATE MA.) to read transmitter plate current. Push the "Press-to-Talk" button on the side of the microphone, or place the SEND-RECEIVE switch on the key to SEND. The meter should indicate, and by advancing the TRANS. ANT. LOADING control in a clockwise direction from its minimum setting (pointer straight up), the loading to the antenna will be increased to the point where the meter indicates mid-scale. This is the proper setting for the antenna adjustment and should always be made by approaching the proper plate current value by a clockwise rotation of the antenna control. Coupling to a point beyond the mid-scale reading on the indicating meter will decrease the life of the transmitter tubes and in most cases results in a decrease in actual power to the antenna rather than an increase. It is, therefore, advisable never to load the transmitter beyond the mid-scale reading on the indicating meter. This brings the transmitter to its proper operating condition at the desired frequency. When making this adjustment of the TRANS. ANT. LOADING control the operator should be crouched or seated beside the Transmitter-Receiver Unit in such a position as to avoid slight frequency errors due to the presence of the man's body in the direct field of the antenna.

(11) For telephone operation, after the above adjustment has been made, it is only necessary to press the "Push-to-Talk" button on the side of the microphone and talk in a normal tone of voice with the face of the microphone approximately one inch from the lips. The SEND-RECEIVE switch on the key must be in the RECEIVE position when telephone operation of the transmitter is being used; otherwise the set will remain in the transmit position after the microphone button has been released.

(12) For MCW operation of the transmitter, place the SEND-RECEIVE switch on the key to the SEND position and operate the key. A side tone is provided in the headphones to enable the operator to hear his own sending. When operating the key while it is fastened on the cover of the Transmitter-Receiver Unit care must be taken that the arm and body of the operator are kept out of the active field of the antenna as much as possible.

CALIBRATION CHECKING

4-3. The crystal calibrator circuit in the Transmitter-Receiver Unit is to be used for checking and readjusting the calibration of both the transmitter and the receiver. This check may be required due to changing tubes, etc., and should also be made at the time of tuning the equipment.

RECALIBRATION AFTER CHANGING TUBES

4-4. To assure proper calibration after changing tubes, it is recommended that the procedure outlined below be followed before the equipment is taken into the field.

Receiver Recalibration Procedure

(1) Whenever tubes are changed in the receiver R.F. circuits (especially true of the detector tube) or for any other reason it is believed the calibration of the receiver may have been affected, the equipment can be recalibrated in the following manner: Turn the equipment "on" for reception and adjust the receiver for operation in the desired band on a channel that is a multiple of 5 megacycles. These crystal check points are clearly indicated on the calibration charts. Turn switch S4 (CRYSTAL ON-OFF) to ON and adjust the RECEIVER TUNING control to the point where super-regeneration hiss is a minimum. Also adjust the REC. ANT. TUNING control for minimum hiss. The receiver is now tuned to the crystal calibrator and the new dial reading should be recorded along with the difference between this dial reading and the dial reading shown on the calibration chart. To make

sure that the receiver is tuned to a harmonic of the crystal calibrator and not to some other signal, turn the crystal "on" and "off" and note that the signal appears and disappears as this is done. At least two points in the band should be checked in this manner. Any constant difference from the calibration chart readings can be compensated for by locking the dials at resonance with the crystal circuit by means of the dial lock, opening the top cover of the Transmitter-Receiver Unit and readjusting the drum to its calibrated reading as taken from the calibration chart. The drum is held in place by friction and can be moved by exerting pressure in the correct direction. The receiver is now in calibration and the desired channel settings can be taken directly from the calibration chart. If the discrepancy is more than 20 dial divisions, the receiver should be carefully inspected for possible damage to the coils or tuning capacitors. If such a condition does exist the equipment should be realigned in accordance with the procedure given in Section VI, Servicing Instructions.

Transmitter Recalibration Procedure

(2) To check the transmitter calibration, switch the equipment ON and place the transmitter in operation as described in Paragraph 4-2, tuning it to a crystal check point. Switch the crystal calibrator ON and carefully readjust the TRANS. TUNING control until a beat note is heard. Be careful to keep the transmitter plate current at its normal value (mid-scale on meter M1) and to make all adjustments in a location where surrounding metal objects are not in close proximity to the antenna. Some hand capacity effect may be noted at certain parts of the frequency range and, if present, this effect should be compensated for by adjusting the TRANS. TUNING control so that the beat note is present with the hand removed. Movement of the operator may also affect the control setting for "zero-beat" due to changing position of his body or of the control cables within the field of the antenna. The operator should, therefore, assume a normal operating position before the set and maintain that position throughout the process of re-calibration. At least two points in the band should be checked and readjusted if necessary, in the same manner as described previously for the receiver. If the deviation is greater than 20 dial divisions a careful check for damage to coils or tuning capacitor should be made and realignment made if necessary per Section VI, Servicing Instructions.

FIELD CALIBRATION CHECK BEFORE TUNING

4-5. Continued or extensive handling of the equipment may cause a slight shift in the tuning mechanism of the Transmitter-Receiver Unit and it is, therefore, advisable to follow the checking procedure outlined below when tuning the equipment to a desired channel for the first time after considerable handling or transportation has taken place.

Receiver Calibration Check

(1) Select the two crystal check points nearest the desired channel as indicated on the calibration chart and check the actual settings of these two points against the calibration chart data. The checking procedure is the same as described in paragraph 4-4 (1). If there is practically no deviation (two divisions or less) the equipment may be tuned in the normal manner (Paragraph 4-2 (5), (6), (7) and (8)), using calibration chart data. However, if there are more than two divisions difference between the crystal checks and the calibration chart data the average dial division difference and direction of this difference (minus or plus) should be determined. Adjustment to any desired channel should then be made by taking the calibration chart data and subtracting or adding as the case may be, the average dial divisions difference or deviation determined above. This procedure, if carried out accurately, will insure the equipment being "on" frequency. This procedure requires very little time and will insure contact with other equipments being made in a minimum of time.

Transmitter Calibration Check

(2) The procedure for checking transmitter calibration and the compensation made for any deviation found is carried out in exactly the same manner as described in Paragraph 4-5 (1), for the receiver. The actual checking against the crystal calibrator is made in the same manner as described in Paragraph 4-4 (2). If conditions of secrecy exclude the possibility of placing the transmitter on the air to check calibration, the equipment should be checked carefully in this regard before taking the equipment into

the field. The receiver, on the other hand, can be checked at any time while in the field as the radiation from this source is very small and at the most travels only a short distance.

OPERATION WHILE BEING TRANSPORTED ON A MAN'S BACK

4-6. When the equipment is to be operated while being carried on a man's back it should first be set up for operation in accordance with Paragraph 3-6, and then tuned in accordance with the following instructions:

Receiver Operation

(1) The operation and tuning of the receiver are to be conducted in exactly the same manner as described in Paragraph 4-2 ((5), (6), (7), (8), and (9)) for fixed station operation. The operation of the receiver and accuracy of frequency setting on the receiver are not materially affected by location of the equipment with respect to ground or surrounding objects. This is so because the receiver selectivity is relatively broad and also because the R.F. amplifier stage prevents any tuning effect of the antenna upon the detector.

Transmitter Operation

(2) Transmitter operation and output frequency are affected somewhat by changes in antenna characteristics such as may be encountered if the transmitter is tuned while on the ground and then hoisted to a man's back. This effect can be avoided, of course, by tuning up the transmitter while it is in position on a man's back. If this is not feasible the effect can be compensated for as follows: Tune the transmitter in the normal manner (Paragraph 4-2 (10)) while on the ground and then lock the transmitter tuning control in place. Then advance the TRANS. ANT. LOADING control until the pointer of meter M1 is approximately $\frac{1}{8}$ inch beyond normal mid-scale value. Next, lift the Transmitter-Receiver Unit to a man's back and note the amount of reduction in plate current as indicated by meter M1. If the meter M1 returns to exactly mid-scale reading the compensation adjustment was correct and no further tuning is necessary. However if the meter still reads higher than the mid-scale value the compensation was too great and coupling must be reduced slightly. Similarly, if the meter drops below the mid-scale value the compensation was not great enough and the adjustment should be repeated with the coupling advanced a little more. This condition varies with frequency and also with length of antenna (see next paragraph). Experience will soon indicate the degree of compensation necessary to produce proper results.

Transmitter and Receiver Unit Operation with Reduced Antenna Length

(3) The antenna lengths specified on the equipment calibration charts are the maximum lengths to be used and give maximum performance. However, it may be necessary at times to operate with reduced lengths of antenna and correspondingly reduced range of transmission. If such operation is desired, the number of antenna sections may be reduced to a minimum of four sections. Reducing the length of the antenna causes a deviation from assigned channel frequency. The extent of this frequency deviation increases as the antenna is shortened. Compensation for this deviation should be taken care of by checking against the crystal calibrator in a manner similar to that outlined in Paragraph 4-3. It may be found that on certain frequencies on each band it will be impossible to load the antenna completely. Adjustment, in this case, should be made for maximum possible loading.

GENERAL OPERATING INSTRUCTIONS

4-7. (1) Two Microphone-Headphone Assemblies, Navy Type CTE-51022B or CTE-51022C are supplied with the equipment to permit more than one man to operate the equipment. As can be seen from the schematic diagram, Fig. 10, Dwg. 52513, Page 59, these two units are connected in parallel when both are plugged into the Transmitter-Receiver Unit. This places the two headphones in parallel across the output winding (terminals 4 and 5) of the output transformer T3, and consequently cuts the load impedance on this winding to $\frac{1}{2}$ normal value. This reduction in load impedance reduces the audio output available from the receiver which may, in the case where extremely weak signals are being picked up, reduce the intelligibility of the signal. In such a case it would be well to disconnect one Microphone-Headphone Assembly until more favorable conditions are encountered. Similarly, the two microphones are in parallel and if both microphone

switches are closed at the same time twice normal microphone current will be taken from the supply battery. Operation should, therefore, never be attempted with both microphones turned "on". One microphone button should always be open when the other is closed. If operation is to be transferred from one operator to the other, the one not talking should immediately release his microphone button.

(2) The CRYSTAL—ON-OFF control switch S4 should never be left ON when this part of the circuit is not in actual use. An unnecessary drain on the battery is imposed when this circuit is left on while not in use. To prolong battery life, therefore, the crystal calibrator should be turned OFF except when needed.

(3) Avoid as much as possible the exposure of the luminescent markings to direct sunlight. Prolonged exposure will cause discoloration and temporary loss of brilliance. A gradual loss of brilliance develops with age. The useful life is from 2 to 6 years. Before replacing parts check markings by placing in a dark room for several hours to be sure loss of brilliance is not temporary and due only to exposure to sunlight.

V. MAINTENANCE

ROUTINE INSPECTION

5-1. To minimize difficulties in service, equipment should be given periodic inspection. In particular, the items mentioned in the following paragraphs should be thoroughly checked for, both in the transmitter unit and in the receiver unit.

CAUTION—*Care must be exercised in removing the chassis from the case to prevent damage to the coils or changing the position of wires. The connection to the concentric line receptacle must be disconnected before the chassis can be removed completely from the case. When the chassis is out of the case, extreme care must be exercised to avoid damage to any of the components, especially the receiver detector variable capacitor and the frequency tuning capacitor of the transmitter. Never lay the unit on its back since doing so may bend the plates of the capacitors located at the extreme rear of the chassis. Bending too slight to be readily detected will change the calibration from that shown on the calibration charts. Before completely reinserting the chassis in its case, the concentric line connection must be made. The correct position for the spade type terminal is straight forward toward the front panels. After this connection has been made, the chassis may be pushed the rest of the way into the case and the nine screws holding the chassis replaced.*

1. Transmitter-Receiver Unit, Navy Type CRI-43044

Check for Looseness and Wear

(a) All screws throughout the unit should be tight.

(b) The detector shield cover should fit tightly and make good electrical contact when in place. If necessary, clean contact surfaces of cover and shield.

(c) All tubes should be tight in their sockets and make good contact.

(d) All controls on front panel should operate freely without binding or excess play. However they should fit snugly enough against the rubber gaskets to prevent the entry of moisture. (See Lubrication, paragraph 5-6).

(e) All contacts on the coil switching assemblies should be making proper contact. They should not be bent or deformed. (See Cleaning and Adjusting, below.)

(f) Coils should not be deformed and all turns should be secured to the small spacing strips.

(g) Wiring should be inspected for loose or broken connections.

(h) Connector plug P1 to battery should be secure and contact prongs should not be bent or deformed.

Cleaning and Adjusting

(i) Transfer relay K1 contacts should be cleaned first by blowing out dust and then a clean strip of paper should be drawn between the contacts a number of times to remove dirt and grit.

(j) The coil contacts and the connector springs on each of the coil assemblies should be cleaned first by blowing out the dust with a hand bellows and then by rotating the coil assemblies several times with a clean sheet of paper inserted between the springs and the coil contacts. Replace or move the paper after each rotation of the coil assembly to provide a clean wiping surface.

(k) The main tuning controls should be cleaned if necessary to remove dust and possible excess grease. (See

Lubrication, Paragraph 5-6.)

(l) Tube prongs should be free from dirt and corrosion. If necessary, they may be cleaned with a fine sandpaper.

(m) All ceramic insulating surfaces should be wiped free of dust and dirt.

(n) All variable capacitors should be cleaned by blowing out with air, to remove dust and dirt avoiding excess pressure that might bend the plates.

(o) The surface of the chassis and that of the case where contact is made between the two should be cleaned to insure good electrical contact.

(p) The enamel covered wire on the coils used in the Transmitter-Receiver Unit should be examined for chipping or flaking of the enamel. Should the enamel chip or flake, touch up the spots as soon as they are noted, with a good grade of quick drying enamel, using a small brush for the purpose. Care must be taken when doing this that the turns are in no way bent or deformed by careless handling of the brush.

(q) The Antenna deflection mechanism should be cleaned of all dirt or grit and checked for proper operation. Friction of the rotating component of the mechanism should be such that the Antenna is held securely at whatever angle it is set. If it appears necessary to adjust the amount of friction, the set screws in the adjusting knob on the mechanism may be loosened using the set screw wrench provided in the top cover of the equipment. The adjustment knob is then free to turn and the friction may be increased or decreased as desired. After adjustment has been made the set screws should be tightened. The deflection mechanism does not require lubrication for proper operation and should be kept free of oil or grease.

2. Antenna, Navy Type CWN-66087 or CWN-66087-S

Check particularly:

(a) All end ferrules should be free of dirt or corrosion and each section should fit properly into the next section.

(b) Sections should be straight and not deformed.

(c) Check the pigtail inside the spring base section for possible breakage or poor electrical connections at the ends.

3. Battery, Navy Type CNC-19018B

The battery may be checked either by actual operation of the equipment or by voltage measurement of the battery itself. If the battery is checked by the latter method, the voltages should fall within the limits given in Paragraph 2-22.

4. Microphone-Headphone Assembly, Navy Type CTE-51022B or CTE-51022C

This assembly should be checked for deterioration of the cord and for possible loose connections at the plug and headphones. Circuit check for continuity at plug terminals in accordance with Fig. 13, Dwg. 52702, Page 62.

5. Key, Cord and Plug Assembly, Navy Type CRH-26013B

Check for deterioration of the cord and for loose connections. Remove bottom cover of key and clean key contacts by passing paper or a fine sandpaper between the contacts. Be sure the bottom gasket is in place when reassembling the case.

5-2. Should the equipment be exposed to the effects of salt water spray, the battery should be removed to prevent electrolysis until the equipment can be dried. After thorough wiping to clean and dry, a small amount of light oil on a soft cloth wiped over the etched name-plate will preserve the finish and prevent the corrosive action of salt water spray.

5-3. All of the aluminum used in the equipment has been treated to resist the effects of salt water spray. Should this surface treatment be scratched or broken, seal the exposed surfaces with clear lacquer. If any screws or nuts have been removed, the surfaces under the lockwashers must be properly treated with clear lacquer. Electrical contact must be maintained, however, in the case of grounding screws and surfaces.

REPLACEMENTS

5-4. The only components which normally may be expected to require occasional replacement are the vacuum tubes and battery. In general, whenever the performance of the equipment is below its previous standard, the tubes should be checked by comparison with tubes known to be good. The battery should be checked to determine whether it is within

the limits for a usable battery as given in paragraph 2-22.

5-5. If, due to normal conditions, components such as transformers, resistors, capacitors, choke coils, etc., fail they should be replaced by similar units taken from the spare parts supplied or as listed under the heading of Parts List, Table II, Pages 34 through 41.

LUBRICATION

5-6. The tuning control bearings, the coil assembly bearings, variable capacitor bearings, etc. should be lubricated once every six months with a few drops of light penetrating oil, such as a good typewriter oil. Care should be taken, however, to see that this lubrication does not get on to rubber parts or the coil connector springs as lubrication at this point will cause poor contact by allowing dirt to accumulate rapidly. Proper procedure is to clean thoroughly all surfaces that are not actually bearing surfaces after lubrication has been applied.

VI. SERVICING INSTRUCTIONS

LOCATION OF TROUBLES

6-1. If the equipment appears inoperative, it is suggested that before looking for defective circuits, the following points be determined:

(a) Is the battery making proper connection to the chassis and if so, are its voltages within the limits given in Paragraph 2-22?

(b) Are all connecting plugs properly inserted and making good contact?

(c) Are all tubes making good contact in their sockets and do all filaments light properly?

(d) Are the band changing coil contacts making good contact? Rotate band switches a number of times and note if equipment returns to the same condition each time.

(e) Is transfer relay making good contact? Operate SEND-RECEIVE switch on Key, Cord and Plug Assembly or "Press-to-Talk" button on microphone a number of times and note if equipment returns to the same condition each time.

(f) Are filament voltages adjusted to proper value as indicated on Meter M1?

(g) Are all tubes good? If no ready means of checking tubes is available replace all tubes with new tubes before checking for defective circuits.

6-2. For checking the various circuits in attempting to locate trouble, the most essential instrument is a voltmeter having a resistance of at least 1000 ohms per volt. An indicating circuit tester or ohmmeter will also prove of value for this work. A combination voltmeter-milliameter-ohmmeter is particularly useful as it provides means for complete checking. See Paragraph 6-22 for complete circuit checking data.

6-3. The schematic diagram and wiring diagram, Figs. 10 and 11, Dwgs. 52513 and 52003, Pages 59 and 60, will prove of value for tracing circuits or locating trouble. In the following sections are listed various troubles that may be experienced in the use and operation of the equipment, together with their probable causes and suggested remedies.

INSUFFICIENT DISTANCE RANGE

6-4. This may be due to the following general causes:

(a) Unsuitable Frequency. Considerable variation in wave propagation exists on different frequencies within the 28 to 80 megacycle range of the equipment. The propagation on any one frequency varies from day to day and even from hour to hour. For this reason considerable care must be exercised in selecting the proper operating frequency to suit the existing conditions.

(b) Improper Operating Site Selected—(Refer to Paragraph 3-3). Often a new site within a very few feet of the original position will greatly improve operation. This is especially true at frequencies above 40 megacycles.

(c) Unsuitable Type of Transmission—Much greater range is obtainable from MCW than from radio telephony. It is best to establish communication by means of MCW and after the equipment is properly tuned radio telephony may then be tried.

FADING OR POOR SIGNAL QUALITY

6-5. This condition may be encountered on frequencies between 28 and 40 megacycles. Fading may occur at either a slow or rapid rate, sometimes so fast that it makes itself evident more by distortion of speech than by noticeable fluctuations in volume. This condition of fading is more likely to occur the closer the operating frequency is to the 28 megacycle end of the frequency range of the equipment. Fading may often be reduced by using

a higher frequency. A common form of apparent fading in voice transmission is due to faulty microphone technique of the operator if he fails to speak closely or evenly into the microphone.

SIGNALS OFF FREQUENCY

6-6. Signals steady but off frequency may be due to calibration being in error. (Refer to Paragraph 4-3.)

TRANSMITTER DOES NOT LOAD

6-7. If transmitter plate current does not rise as antenna coupling is increased (refer to paragraph 4-2 (10)), the following may be the cause:

(1) Transmitter not oscillating. May be caused by any one of the following:
  (a) Poor Transmitter tubes — Replace with new tubes.
  (b) Battery dead—Battery too low to allow transmitter to oscillate. This condition is sometimes apparent by a rise in plate current when coupling is first increased but drops suddenly as coupling is further increased. Remedy: Replace with fresh battery.
  (c) Grid resistor R4 or grid choke L10 open—Replace with new part from spare parts.
  (d) Low filament voltage—Adjust filament to proper value (mid-scale on meter M1).

(2) Antenna circuit open. Check circuit through contacts "F" of transfer relay K1. Check contacts to coupling coil S3 on the transmitter coil assembly.

(3) Antenna circuit grounded. Check for dirt or bent plates in antenna coupling capacitor C13. Check for ground at contacts of K1 and at concentric line terminal.

(4) Poor relation between antenna and ground. It may be found at times that by moving the location of the equipment closer to ground the loading can be increased to normal.

TRANSMITTER DOES NOT DRAW PLATE CURRENT

6-8. If the transmitter does not draw plate current as indicated on Meter M1, check the following parts of the circuit.
  (a) Plate resistor R3 for open circuits.
  (b) Contacts of transmitter band switch S3 for open circuit.
  (c) Contacts of meter switch S5 for open circuits at the mid-position.
  (d) Transformer T3 secondary winding (terminals 6 and 7) for open circuit.
  (e) Bypass capacitor C28 for short circuit.
  (f) Plate supply contacts K1-E open.

TRANSMITTER LOADS PROPERLY BUT DOES NOT MODULATE ON PHONE

6-9. If the transmitter appears to load into the antenna properly but voice transmission is weak or does not exist at all, the following points should be checked:
  (a) Check the 7½ volt section of the battery for proper voltage.
  (b) Check microphone button for proper operation. Try second Microphone-Headphone Assembly. If operation is the same on both, the chances are both units are functioning properly and connections at P2 and P3 are correct.
  (c) Check microphone winding (terminals 3 and 4) on transformer T2 for open circuit.
  (d) Check microphone resistor R11 for open circuit.
  (e) Check continuity of secondary winding (terminals 5, 6 and 7) on transformer T2.
  (f) Check for proper operation of output audio tube V7 by measuring all voltages at this tube.
  (g) Check continuity of primary winding (terminals 1, 2 and 3) on transformer T3.

TRANSMITTER LOADS PROPERLY BUT DOES NOT MODULATE ON MCW

6-10. If the transmitter appears to load into the antenna properly but does not modulate when the key is closed it should be apparent by absence of side tone in head-set. The following points should be checked.
  (a) Check for open circuit in the key circuit consisting of the key, send-receive switch S101, key, cord and plug connections.
  (b) Check for open circuit of winding (terminals 5 and 6) on Transformer T1.
  (c) Check for open circuit of resistors R12 and R13 and capacitor C25.
  (d) Check windings (terminals 3 and 4) on transformer T1 and (terminals 1 and 2) on transformer T2.
  (e) Check for open circuit at contacts "C" of relay K1. This can be checked by advancing the volume control R7 to the full "on" position. If contacts are satisfactory, position of volume control will make no difference in operation.

(f) Check remaining parts of audio circuit as outlined in paragraph 6-9.
(g) Check capacitor C24 for short circuit.

MCW OPERATION PRODUCES UNNATURAL AUDIO FREQUENCY

6-11. If operation appears proper on MCW but the side tone is not approximately 800 cycles, check for an open circuit in capacitor C24. If this does not correct the trouble, check C21, C22, C25, R7, R12, and R13, as these parts also affect the frequency obtained on MCW.

RECEIVER DOES NOT SUPER-REGENERATE

6-12. If no position of the regeneration control will produce the characteristic super-regenerative hiss in the headset, the following parts of the circuit should be checked:
(a) Change receiver detector tube and if trouble is not remedied, proceed with the following checks.
(b) Check for open circuit in the detector band change contacts S2.
(c) Check for open circuit of grid resistor R2.
(d) Check for open or short circuit of capacitors C7, C8, C11 and C12.
(e) Check for short or open circuit in chokes L12 and L13.
(f) Check for open circuit in transformer T1 winding (terminals 1 and 2).
(g) Check for open circuit in regeneration control R8 or resistor R10.

LACK OF SENSITIVITY IN RECEIVER

6-13. If the receiver appears to be operating properly as indicated by normal action of the regeneration control, but signals are all weak or completely missing, check the following circuits:
(a) Check for defective R.F. tube.
(b) Check that the grid and plate clips are in position on tube V1.
(c) Check for open antenna circuit by looking for open or poor connections at contacts "E" of relay K1; broken or grounded shielded lead between relay K1 and the range switch assembly S1; poor or open contact at the contacts of range switch S1.
(d) Check for grounded or short circuited tuning capacitor C1 or trimmer C2 in the R.F. stage.
(e) Check for open circuit in plate circuit of the R.F. tube at the contacts of the detector band switch S2.
(f) Check for open circuit of screen resistor R1 and plate choke L11.
(g) Check C4 and C5 for open or short circuits.
(h) If the above checks do not reveal the source of trouble, check alignment of the receiver per paragraph 6-21.

RECEIVER COMPLETELY DEAD

6-14. If the receiver appears to be completely dead the trouble can be either in the R.F. section or the audio section. The procedure to follow in determining which circuit is defective is to change to the transmit position and operate the equipment on MCW and voice transmission. If these two modes of transmission function properly it can be assumed that the audio system is functioning. If however, these modes of transmission do not function properly the trouble probably lies in the audio system and the procedure of checking should be similar to that outlined in paragraphs 6-9 and 6-10. If from the above check, the trouble appears to be in the R.F. section, follow the procedure outlined below:
(a) Check for open circuit in the plate supply to the detector tube by checking resistors R8, R10, transformer T1 winding (terminals 1 and 2), inductance L12 and contacts of switch S2 for open circuit.
(b) Check headphone circuit for open circuit by checking winding (terminals 4 and 5) on transformer T3; connection from T3 (terminal 4) to J1 and J2; connection from T3 (terminal 5) to ground and continuity of headphone set.
(c) Repeat checks outlined in Paragraph 6-12.

EXTREMELY STRONG SIDE TONE ON MCW

6-15. If, with the equipment normal in all respects except that when operating MCW, an extremely strong side tone signal in the headphones is obtained the trouble is a short circuit of resistor R16. This short circuit may be due to improper operation of contacts "B" on relay K1 or a direct wiring short.

CRYSTAL CALIBRATOR DOES NOT OSCILLATE

6-16. If, when the crystal calibrator is turned "on" and no reduction in super-regenerative hiss can be heard when tuning through the receiver frequency range, it can be assumed that the calibrator circuit is not oscillating. The probable causes are:
(a) Crystal defective or making poor contact in its socket. Clean crystal holder contacts and socket contacts and shake crystal gently.

(b) Grid resistor R5 open.
(c) Plate coil L14 open or plate capacitor C19 open or defective.
(d) Plate resistor R6 open.
(e) If tube V5 does not light, switch S4 may be defective or R9 may be open.

CRYSTAL FUNCTIONS FOR RECEIVER CALIBRATION BUT NOT FOR TRANSMITTER

6-17. It is possible for the crystal oscillator to be oscillating properly and thereby allow calibration of the receiver in accordance with Paragraph 4-5 (1), but at the same time be unable to hear a beat note when trying to calibrate the transmitter per Paragraph 4-5 (2). In this case, check the coupling circuit from L14, R6 through capacitor C20 to the input transformer T1 (terminal 2) for open circuit or grounding.

INSTRUCTIONS FOR SERVICING THE EQUIPMENT

6-18. In addition to the periodic check on the operation of the equipment as outlined in Section V it is recommended that, whenever possible, the equipment be subjected to a complete service check-up and re-alignment. The procedure to be followed and the data necessary are as follows:

GENERAL SERVICING INSTRUCTIONS

6-19. The equipment should be set up and operated in accordance with instructions contained in Sections III and IV of this book. If, during the course of operation, the equipment does not appear to function properly the troubles should be located and remedied with the help of the procedure given in paragraphs 6-1 through 6-17, inclusive. The equipment should then be subjected to the inspection, adjusting, cleaning and lubrication procedure covered in Section V. The following additional checks and adjustments should be made.

(1) **Indicating Meter M1 Check**—Check the three ranges of the meter on the panel by comparing with calibrated instruments. *No tubes should be in their sockets while these tests are being made.* Deflection of the needle to the mid-point marking on the scale should indicate as follows:

Selector Switch Position	Calibration
AUDIO FIL. voltage	2.0 volts
TRANS. PLATE M. A.	16 ma.
R.F. FIL. voltage	1.28 volts

(Calibration should be within plus or minus 5 per cent.)

(a) In the AUDIO FIL. voltage position the input voltage can be applied between the filament rheostat and the chassis with the comparative reading taken from the filament terminals of tubes V6 or V7.
(b) Connection for the TRANS. PLATE M. A. reading must be between the power plug and resistor R3.
(c) For the R.F. FIL. voltage position, the input voltage can be connected between the corresponding rheostat terminal and the chassis. The standard meter should be connected to the Navy Type-958A detector tube filament clips in the receiver portion of the set.
(d) If the measurements indicate an inaccuracy greater than plus or minus 5 percent, the meter should be removed from the equipment and checked by itself. At mid-scale the accuracy of the meter should be plus or minus 4 percent. Replace resistors R17, R18 and R19, if necessary to bring the meter within the plus or minus 5 percent limit when in the equipment.

After the above procedure has been followed the Transmitter-Receiver Unit should be tested and realigned if necessary according to the following procedure:

TRANSMITTER ADJUSTMENTS

6-20. The transmitter should be checked for accuracy of calibration, power output and modulation in the following manner:

(1) **Calibration and Realignment**—The calibration of the transmitter should be checked in accordance with the procedure given in paragraph 4-4 (2) if it has not previously been done under paragraph 6-19. If the calibration is found to be correct or easily compensated for no further work is necessary. However, if the calibration is "off" to the extent that readjustment by means of the vernier drum dial is impractical, the transmitter coils or condenser may be readjusted to correct calibration. The readjustment by this means, however, should be made only by thoroughly experienced personnel and then only after it is definitely known to be necessary. Exact calibration varies with location to such an extent that unless checking is done under similar conditions to those used in making the original calibration, the extent to which the calibration is "off" is questionable. Set the Transmitter-Receiver Unit in the center of a four foot square metal plate which is resting on top of a table

or bench. The table should be so located that surrounding objects are at least 15 or 20 feet away. The operator should be seated before the equipment and remain in that position while checking calibration. If all the bands appear to be "off", the trouble probably is in the tuning condenser or the setting of the dial with respect to the tuning condenser. Otherwise, the trouble probably is in the coil of the band that is "off". To readjust the coil proceed as follows: Note in which direction the calibration is "off", whether high or low in frequency. Remove the coil from the coil assembly by removing the two screws that hold each end of the coil supporting insulation strip. Bend the two end turns of the coil a small amount toward the coil to raise the inductance (lower the frequency) or away from the coil to lower the inductance (raise the frequency), as needed. Replace the coil and check the calibration again and repeat the process until the calibration is accurate. Repeat the procedure for each coil, if necessary, until the calibration on each band is correct. Bending of the capacitor plates to secure calibration should not be attempted.

(2) **Power Output Check**—The power output of the transmitter may be checked by the photometric method, using a dummy antenna made in the following manner Enclose in a small light-tight box, a 100 mmfd. variable capacitor, a 6 volt-0.15 ampere lamp (brown bead), a photo-electric cell and a microammeter, 0-500 range. The variable capacitor and 6 volt light are connected in series. The variable capacitor should connect to the concentric line terminal of the Transmitter-Receiver Unit and the lamp return made to the case of the Unit. The photo-electric cell should be placed to receive light from the 6 volt lamp, with the microammeter used to measure the cell output. Calibrate this dummy antenna on either A.C. or D.C. at various points so that the microammeter readings will indicate watts in the 6 volt lamp directly. Substitute this measuring box (dummy antenna) for the antenna of the equipment. The connecting leads should be as short as possible. Adjust the TRANS. ANT. LOADING control and the capacitor in the output measuring box for maximum deflection on the microammeter, with plate meter reading properly at mid-scale. The transmitter power output with the key open (Carrier) should be at least 0.5 watts at any calibrated portion of each band. The uncalibrated "overlap" portion may be slightly below this value. With the telegraph key closed the MCW power output should be at least 50% greater than for the open key condition. A fairly approximate check can be made without the photocell and microammeter by noting the brilliancy of the 0.15 amp. lamp connected in series with the 100 mmfd. variable capacitor. The unmodulated carrier should light the lamp to somewhat less than full brilliance. With MCW the lamp brilliance should be more than normal.

RECEIVER ADJUSTMENTS

6-21. The receiver should be checked for accuracy of calibration and sensitivity in the following manner:

(1) **Calibration and Realignment**—The calibration of the receiver should be checked in accordance with the procedure given in Paragraph 4-4 (1). If the calibration is "off" to the extent that considerable readjustment of the dial drum is necessary, the receiver should be realigned in accordance with the instructions given below. The same set-up as described in Paragraph 6-20 (1) is to be used. Whether the receiver calibration is satisfactory or not does not exclude the necessity for realignment to secure maximum sensitivity.

(2) **Realignment Procedure**—Check calibration per Paragraph 4-4 (1) on each of the bands to determine which bands must be readjusted. After this has been determined, the procedure is similar to that described for the transmitter. The detector tuning inductances L4, L5, L6 and L16 determine the frequency coverage of the receiver and, therefore, are the coils which must be readjusted. Determine in which direction the inductance of each coil must be changed and proceed to bring each coil in line, in the same manner as was done for the transmitter. The R.F. coils L1, L2, L3 and L15 are not to be touched at this time. Each coil should be brought in line with the calibration data as nearly as possible and exact calibration obtained by a final slight readjustment of the dial drum. (See Procedure of Paragraph 4-4 (1)). If all bands are "off" and readjustment of the drum dial fails to bring them back, the indication is that tuning capacitor C6 has been damaged. Bending

of its plates to secure calibration should be attempted only by thoroughly experienced personnel.

(3) **Sensitivity Adjustment**—After the calibration and realignment have been completed in accordance with the two previous paragraphs, the receiver sensitivity should be checked. The equipment necessary is:

(a) One high frequency standard signal generator, Ferris Instrument Corporation Microvolter Model 18B or equivalent, with internal modulation capable of being maintained at 30 percent.

(b) One Output Meter, General Radio Type 583-A or equivalent.

Connect the Microvolter between the antenna post and chassis with the antenna removed. Remove the headphones from both jacks J1 and J2 and temporarily connect the output meter in place of the headphones. Set the output meter impedance for 600 ohms. Connection is made to the upper and lower of the four contacts on either J1 or J2. Set the Microvolter frequency to 28 Mcs. (by reference to Microvolter calibration) and advance the output attenuator to a value of 100 microvolts or more. Tune the receiver to this signal making sure the REC. ANT. TUNING control and the REGEN. control are adjusted for maximum sensitivity (See Paragraph 4-2 (8)). The final sensitivity measurements depend to a great extent on proper setting of the regeneration control. Care should be taken to find the point at which maximum sensitivity is obtained. The output of the Microvolter and the volume and regeneration controls of the receiver are then to be adjusted until the unmodulated signal reduces the noise level to 0.25 milliwatts in 600 ohms (0.387 volts on output meter). The addition of 30 percent modulation at 400 cycles then should give a receiver output of 1.0 milliwatt in 600 ohms (0.775 volts on output meter). Sensitivity of the receiver is read directly from the output attenuator on the Microvolter when the adjustments produce the above results. It will be noted when making these adjustments that the sensitivity of the receiver depends entirely upon securing the proper settings of the REC. ANT. TUNING, VOLUME and REGEN. controls. Until familiar with the procedure, numerous trials of various settings of these controls may be necessary. Repeat the procedure at frequencies of 33, 36, 43, 49.5, 57 and 65 megacycles. If the sensitivity at all these frequencies is approximately 5 microvolts or better the receiver is in proper working order and no further work is necessary. If the sensitivity at some frequencies is appreciably poorer than 5 microvolts, (sensitivity of Band 4 is approximately 15 microvolts) proceed as follows:

(a) Check the tubes by replacing with a set known to be good.

(b) Note whether the antenna tuning control is actually tuning through resonance at the frequencies in question. It may be possible that the R.F. tuning coils L1, L2, L3 and L15 have shifted, due to continued handling of the equipment, so that the antenna tuning capacitor C2 is not tuning properly. This is evidenced by this capacitor producing maximum sensitivity at either its extreme maximum or minimum point indicating that it is not quite tuning to resonance. To correct this situation it may be necessary to distort the end of L1, L2, L3, or L15 slightly to bring the tuning of C2 back within its range. If the capacitor C2 has to be set at minimum value the inductance should be reduced slightly by moving the end turn a small amount away from the coil proper. Similarly, if the capacitor C2 is set at maximum capacity the inductance of L1, L2, L3 and L15 should be increased by moving the end turn slightly closer to the coil proper. Make this adjustment so that the capacitor C2 is definitely tuning through resonance as indicated by visual inspection. Do not change L1, L2, L3 or L15 to the extent that C2 will not tune properly at the opposite end of the range. The change required in L1, L2, L3 and L15 should be very slight so the adjustment should be made with care.

CIRCUIT CHECKING DATA

6-22. (1) **Tube Contact Voltages — Remove all** vacuum tubes from their sockets and install a fresh battery in place. The following values as measured with a 1000 ohms per volt meter should then be obtained if all circuits are in order. Variations of $\pm 5\%$ may be expected.

Tube Symbol	Function	Filament Voltage (a)	Plate Voltage	Grid Voltage	Screen Grid Voltage
V1	Rec. R.F.	1.6	167	—.06(d)	36(e)
V2	Rec. Det.	1.6	125(c)	+14(e)	.....
V3,V4	Trans.	1.6(b)	166(b)	0	.....
V5	Crystal	3.2	155	0	.....
V6	1st Audio	3.2	167	—6.2(f)	.....
V7	Final Audio	3.2	167	—6.7	167

(a) With rheostats R14 and R15 fully clockwise.

(b) With relay K1 closed.

(c) With REGEN. control fully clockwise.

(d) On 2.5 V scale.

(e) On 100 V scale.

(f) VOLUME control R7 fully clockwise.

(2) **Point-to-Point Resistance Measurements**—With all vacuum tubes removed from their sockets, headphone and key plugs disconnected, and the battery disconnected the following resistance values should be obtained between tube socket connections and ground or chassis.

Resistance Value in Ohms

Tube Symbol	Function	Filament Terminal	Plate Terminal	Grid Terminal	Screen Grid Terminal
V1	Rec. R.F.	25	550,000	200,000	1.55 meg.
V2	Rec. Det.	25	500,000(a)	1.5 meg.(a)	.....
V3,V4	Trans.	Infinity	550,000	5,000	.....
V5	Crystal	Infinity	550,000	100,000(b)	.....
V6	1st Audio	Infinity	550,000	450,000(c)	.....
V7	Final Audio	Infinity	550,000	450,000	550,000

(a) With REGEN. control R8 fully clockwise.

(b) With CRYSTAL switch ON.

(c) VOLUME control either fully "on" or "off". The values of resistance in the following table are those obtained by measurements between plate terminal at each socket and the B+ switch S-9.

Tube	V1 Rec. R.F.	V2 Rec. Det.	V3, V4 Trans.	V5 Crystal	V6 1st Audio	V7 Final Audio
Resistance Plate to S-9	32	50,000*	760**	20,000	1300	1000

* Value with REGEN. control R8 in max. clockwise position. This increases to 550,000 ohms as R8 is moved to min. position.

**With relay closed.

To further facilitate resistance measurements in the plate and grid circuits of each tube, the resistance of each winding of the audio transformers T1, T2, and T3 is:

Transformer T1 Resistance Values

Primary (terminals 1 to 2)—1750 ohms plus or minus 15%

Secondary (terminals 3 to 4)—2900 ohms plus 15% minus 25%

Secondary (terminals 5 to 6)—1300 ohms plus or minus 15%

Transformer T2 Resistance Values

Primary (terminals 1 to 2)—1300 ohms plus or minus 15%

Mic. Winding (terminals 3 to 4)—18 ohms plus 25% minus 15%

Secondary (terminals 5 to 7)—4000 ohms plus or minus 15%

Transformer T3 Resistance Values

Primary (terminals 1 to 3)—2000 ohms plus or minus 15%

Secondary (terminals 4 to 5)—350 ohms plus or minus 15%

Secondary (terminals 6 to 7)—495 ohms to 700 ohms

(3) **Current Measurements**—The following are current measurements in milliamperes taken between the battery and the Transmitter-Receiver Unit, using a fresh battery. These values are with the antenna removed from the unit and indicate the current drain from the battery under test conditions with no power being delivered to the antenna.

	Bias Lead	Fil. Lead	Fil. Lead	Plate Lead
Nominal Voltage	—7.5 volts	+1.5 volts	+3 volts	+150 volts
SEND POSITION				
Actual Voltage*	—8.0	+1.5	+3.0	156
Current in M.A.	.02(a)	190	330	30
RECEIVE POSITION				
Actual Voltage*	—8.0	+1.5	+3.0	156
Current in M.A.	.02	190	280	22

* With 1000 ohms per volt instrument.

(a) With Send-Receive switch at Send. Goes to 10-40 ma. when microphone button is pressed.

TABLE I

LIST OF MAJOR UNITS

FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Navy Type Designation	Name of Major Unit	Symbol Group	Assembly Drawing Number
CRI-43044	Transmitter-Receiver Unit	1 to 99	48622
CRH-26013B	Key, Cord and Plug Assembly	101 to 199	48527-G2
CTE-51022B or CTE-51022C	Headphone and Microphone Assembly	201 to 299	52062-G2 52062-G3
CFG-10197	Shipping Chest		52011
CSS-10039B	Canvas Carrying Case		51932
CNC-19018B	Battery Pack		52060
CWN-66087 or CWN-66087-S	Antenna (Ten Sections)		48536 52502

TABLE II

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	MFR	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				CAPACITORS						
		C-1	R.F. Tuning Capacitor	3 MMF. Min., 14 MMF. Max. Variable Air			21	48595		48595
		C-2	Receiver Antenna Tuning Capacitor	2 MMF. Min., 6 MMF. Max. Variable Air			21	52001		52001
	*	C-3	Receiver R.F. Grid By-Pass Capacitor	0.003 MFD. ±10%, 500 V.D.C. Working, Mica	−481036-B10	AWS C75.3 1942	1 15	1-WLS #1467 LS		48649
	*	C-4	Receiver R.F. Screen Grid By-Pass Capacitor	Same as C-3						
	*	C-5	Receiver R.F. Plate By-Pass Capacitor	0.002 MFD. ±10%, 500 V.D.C. Working, Mica	−48856-B10	AWS C75.3 1942	1 15	1-WLS #1467 LS		48646
		C-6	Receiver Detector Tuning Capacitor	2 MMF. Min. 14 MMF. Max. Variable Air			21	48782		48782
	*	C-7	Receiver Detector Grid Capacitor	0.0001 MFD. ±10%, 500 V.D.C. Working, Mica	−48674-B10	AWS C75.3 1942	1 15	5-WLS #1468 LS		48642
	*	C-8	Receiver Detector Plate By-Pass Capacitor	0.006 MFD. ±10%, 300 V.D.C. Working, Mica	−48847-B10	AWS C75.3 1942	1 15	1-WLS #1467 LS		48651
	*	C-9	Receiver Detector Cathode By-Pass Capacitor	Same as C-3						
	*	C-10	Receiver R.F. Plate Filter Capacitor	Same as C-8						
	*	C-11	Receiver Detector Plate Capacitor	Same as C-3						
	*	C-12	Receiver Detector Cathode Filter Capacitor	Same as C-8						
		C-13	Transmitter Antenna Tuning Capacitor	5.6 MMF. Min. 100 MMF. Max. Variable Air			21	48624		48624
		C-14	Transmitter Tuning Capacitor	Two sections, Max. Capacity per section 22 MMF., Min. Capacity per section 2 MMF. Variable Air			21	48502		48502
	*	C-15	Transmitter Grid Coupling Capacitor	0.00005 MFD. ±10%, 500 V.D.C. Working, Mica	−48895-B10	AWS C75.3 1942	1 15	5-WLS #1468 LS		48623
	*	C-16	Transmitter Grid Coupling Capacitor	Same as C-15						
	*	C-17	Transmitter Grid By-Pass Capacitor	0.0005 MFD. ±10%, 500 V.D.C. Working, Mica	−48691-B10	AWS C75.3 1942	1 15	5-WLS #1468 LS		48643

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.

TABLE II (cont.)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	MFR	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				CAPACITORS (Cont.)						
	*	C-18	Transmitter Plate By-Pass Capacitor	Same as C-17						
	*	C-19	Crystal Plate Tank Capacitor	0.00002 MFD. ±10%, 500 V.D.C. Working, Mica	—48783-B10	AWS C75.3 1942	1 15	5-WLS #1468LS		48621
	*	C-20	Crystal Output Coupling Capacitor	0.001 MFD. ±10%, 500 V.D.C. Working, Mica	—48983-B10	AWS C75.3 1942	1 15	1-WLS #1467 LS		48645
	*	C-21	Receiver Detector Audio By-Pass Capacitor	0.1 MFD. ±10%, 400 V.D.C. Working, Molded Paper			24	Type 345		48652
	*	C-22	Audio Grid By-Pas Capacitor	Same as C-17						
	*	C-24	Audio Regeneration Capacitor	0.005 MFD. ±10%, 300 V.D.C. Working, Mica	—481037-B10	AWS C75.3 1942	1 15	1-WLS #1467LS		48650
	*	C-25	Audio Regeneration Coupling Capacitor	Same as C-8						
	*	C-26	Modulation Plate Loading Capacitor	Same as C-20						
	*	C-27	Modulation Plate Loading Capacitor	Same as C-20						
	* *	C-28A C-28B	Audio Grid By-Pass Capacitor Plate Supply By-Pass Capacitor	0.1-0.1 MFD. ±10%, 600 V.D.C. Working, Paper	—48712-B	RE 48A 129H	1 15	DYR-6011-2 630		48653
	*	C-29	Transmitter Coupling Capacitor	Same as C-7						
	*	C-30	Receiver R.F. Plate By-Pass Capacitor	Same as C-5						
				JACKS AND RECEPTACLES						
	*	J-1	Head Phones and Microphone Plug Receptacle	4 Contacts			5	#91-501		52538
	*	J-2	Head Phones and Microphone Plug Receptacle	Same as J-1						52538
	*	J-3	Key Plug Receptacle	4 Contacts			5	#91-502		52539
	*	J-4	Antenna Connector Receptacle	Single Contact	—49194	RE 49F 167D	5 3	83-1R 7130		48787

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.

TABLE II (cont.)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	MFR	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				RELAYS						
	*	K-1	Transmitter-Receiver Transfer Relay	Relay, five pole, double-throw to operate under normal voltage 3.0, min. voltage 2.0, max. current 0.125 amp. Contacts: B-one make and break (S.P.D.T.); C-one make and break (S.P.D.T.); D-one make and break (S.P.D.T.); E-one make; F-one make and break (S.P.D.T.). All contacts insulated.	—29230		14	C-11943		52515
					—29230		39	19890		52529
				INDUCTORS AND CHOKES						
		L-1	R.F. Receiver Range 1 Coil	13 turns, #16 enameled wire, ¾" O.D. x 1" long			21	48606		48606
		L-2	R.F. Receiver Range 2 Coil	9 turns, #16 enameled wire, ¾" O.D. x 11/16" long			21	48717		48717
		L-3	R.F. Receiver Range 3 Coil	6 turns, #16 enameled wire, ¾" O.D. x 9/16" long			21	48610		48610
		L-4	Receiver Detector Range 1 Coil	14 turns, #16 enameled wire, .83" O.D. x 1" long			21	48715		48715
		L-5	Receiver Detector Range 2 Coil	10 turns, #16 enameled wire, ¾" O.D. x ¾" long			21	48716		48716
		L-6	Receiver Detector Range 3 Coil	8 turns, #16 enameled wire, ⅝" O.D. x ⅝" long			21	48713		48713
		L-7	Transmitter Range 1 Coil	20 turns, #16 enameled wire, ⅞" O.D. x 1¾" long			21	48572		48572
		L-8	Transmitter Range 2 Coil	14 turns, #16 enameled wire, ⅞" O.D. x 1½" long			21	48561		48561
		L-9	Transmitter Range 3 Coil	10 turns, #12 enameled wire, ⅞" O.D. x 1⅜" long			21	48566		48566
	*	L-10	Transmitter Grid Choke Coil	60 turns, center tap. #31 D.S.C. wire, on ¼" form			21	48541		48541
	*	L-11	Receiver R.F. Plate Filter Choke	2.1 millihenrys, 35 ohms, 1 MMF., 125 milliamps			21	48540		48540
	*	L-12	Receiver Detector Plate Filter Choke	250 millihenrys, 575 ohms, 50 milliamps			21	MX-78		MX-78

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.

TABLE II (cont.)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	MFR	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				INDUCTORS AND CHOKES (Cont.)						
	*	L-13	Receiver Detector Cathode Filter Choke	44 turns, #25 D.S.C. wire, 1" long x ¼" O.D.			21	48542		48542
	*	L-14	Crystal Calibrator Plate Coil	20.1 microhenries, #31 D.S.C. wire, 1 1/16" long x 3/8" O.D.			21	48537		48537
		L-15	R.F. Receiver Range 4 Coil	6 turns, #16 enameled wire, 5/16" O.D. x 5/8" long			21	48609		48609
		L-16	Receiver Detector Range 4 Coil	6 turns, #16 enameled wire, 5/8" O.D. x 5/16" long			21	48714		48714
		L-17	Transmitter Range 4 Coil	7 turns, #12 enameled wire, 7/8" O.D. x 1 3/8" long			21	48570		48570
				ELECTRICAL INDICATING INSTRUMENTS						
	*	M-1	Transmitter loading and filament meter	0 to 5 milliamps. Full scale, scale to be blank except for 1/8" wide mark at midscale and a zero adjustment line. Pointer and midscale to be luminous with nonglare glass dial. Background to be black		17-1-12A Modified Per Par. 2-2 (1)	4	NX-33		51914
				PLUGS						
	*	P-1	Power Plug	5 Prongs			5	#RCP 5		51926
	*	P-101	Key Plug	4 Prongs			5			52700
	*	P-201	Microphone Plug	4 Prongs			5			52701
				RESISTORS AND POTENTIOMETERS						
	*	R-1	Receiver R.F. Screen Resistor	1 megohm ±10%, ½ watt, insulated	—63360		25	EB-½		52549
	*	R-2	Receiver Detector Feed Back Resistor	Same as R-1						52549
	*	R-3	Transmitter Plate Filter Resistor	100 ohms ±10%, ½ watt, insulated	—63360		6 25 26	BT-½ EB-½ MB-½		48734

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.

TABLE II (cont.)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	MFR	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				RESISTORS AND POTENTIOMETERS (Cont.)						
	=	R-4	Transmitter Grid Bias Resistor	5,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		△T-7606438 P82
	*	R-5	Crystal Calibrator Grid Resistor	100,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		△T-7606438 P83
	*	R-6	Crystal Calibrator Plate Resistor	20,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		△T-7606438 P84
	*	R-7	Audio Volume Control Potentiometer	500,000 ohms ±10%, ½ watt, composition, logarithmic taper			6	Type CS taper "C"		48785
	*	R-8	Receiver Regeneration Control Potentiometer	500,000 ohms ±10%, ½ watt, composition, linear taper			6	Type CS taper "A"		48784
	*	R-9	Crystal Calibrator Filament Resistor	14 ohms ±2%, ½ watt, wire wound, insulated	−63678-2	RE 13A 372J	6	BW-½		△T-7606438 P87
	*	R-10	Receiver Regeneration Control Resistor	50,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		48735
	*	R-11	Microphone Resistor	100 ohms ±10%, ½ watt, wire wound, insulated	−63678-10	RE 13A 372J	6	BW-½		△T-7606438 P89
	*	R-12	Audio Feed Back Resistor	Same as R-10						
	*	R-13	Audio Feed Back Resistor	10,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		△T-7606438 P91
	*	R-14	Audio Filament Rheostat	3.6 ohms, 0.6 amp. wire wound, linear			22	252		48758
	*	R-15	R.F. Filament Rheostat	Same as R-14			22	252		48758
	*	R-16	Head Phone Series Resistor	Same as R-10						
	*	R-17	Meter Shunting Resistor	0.625 ohm +2%, −7½%, ½ watt, non-insulated			12	Type 506		△T-7606438 P95
	*	R-18	Meter Series Resistor	800 ohms ±2%, ½ watt, wire wound, insulated	−63678-2	RE 13A 372J	6	BW-½		△T-7606438 P96
	*	R-19	Meter Series Resistor	535 ohms ±2%, ½ watt, wire wound, insulated	−63678-2	RE 13A 372J	6	BW-½		△T-7606438 P97
	*	R-20	Receiver Filament Series Resistor	25 ohms ±5%, ½ watt, wire wound, insulated	−63678-5	RE 13A 372J	6	BW-½		△T-7606438 P98
	*	R-21	Bias Potentiometer Resistor	200,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		△T-7606438 P99
	*	R-22	Bias Potentiometer Resistor	250,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		△T-7606438 P100
	*	R-23	Audio Input Load Resistor	75,000 ohms ±10%, ½ watt, insulated	−63360		6	BT-½		△T-7606438 P101

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.
△Westinghouse Electric & Mfg. Co. Drawing.

TABLE II (cont.)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	MFR	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				SWITCHES						
		S-1	Receiver R.F. Band Switch	5 Contact Switch, part of Receiver Unit			21	48558		48558
		S-2	Receiver Detector Band Switch	5 Contact Switch, part of Receiver Unit			21	48558		48558
		S-3	Transmitter Band Switch	7 Contact Switch, part of Transmitter Unit			21	48502		48502
	*	S-4	Crystal Calibrator on-off Switch	Double-pole, Double-throw, 6 amps. at 125 volts A.C. $\frac{1}{32}$" Bushing, Toggle Type			8	Similar to #8373		52006
	*	S-5	Meter Switch	Double-pole, Three-position, Rotary Type			22	NW-228-23		52004
	*	S-6	Power on-off Switch (Filament)	Same as S-4						
	*	S-9	Power on-off Switch (Bias and B+)	Same as S-4						
	*	S-101	Key Switch	Double-pole, Single-throw, special, 3 amps. at 125 volts, toggle type			11 36	#20902-P 1GA2A1		51916
				TRANSFORMERS						
	*	T-1	Audio Input Transformer	200 to 2500 cycle. Primary (Terminals 1 to 2) 2 milliamps 3000 turns, 1750 ohms ±15%. Secondary S-1 (Terminals 3 to 4) 6000 turns, 2900 ohms +15% −25%. S-2 (Terminals 5 to 6) 2000 turns, 1300 ohms ±15% Test Voltage—1500 volts between each winding and to can			9	48689		48689
	*	T-2	Audio Interstage Transformer	200 to 2500 cycle. Primary P-1 (Terminals 1 to 2), 4 milliamps 2900 turns, 1300 ohms ±15%, P-2 (Terminals 3 to 4) 216 turns, 18 ohms +25% −15%. Secondary (Terminals 5 to 6 to 7) 7100 turns, with center tap, 4000 ohms ±15% Test Voltage—1500 volts between each winding and to can			9	48690		48690
	*	T-3	Modulation Transformer	200 to 2500 cycle. Primary (Terminals 1 to 2 to 3) 5000 turns, with center tap, 2000 ohms ±15%. Secondary S-1 (Terminals 4 to 5) 750 turns, 350 ohms ±15%. S-2 (Terminals 6 to 7) 16 milliamps. 3000 turns 495-700 ohms Test Voltage—1500 volts between each winding and to can			9	48691		48691

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.

TABLE II (cont.)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	MFR	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				VACUUM TUBES						
*	*	V-1	Receiver R.F. Vacuum Tube		—959	JAN-1A	13	959		△P-7707146 P6
*	*	V-2	Receiver Detector Vacuum Tube		—958A	JAN-1A	13	958A		△P-7707146 P5
*	*	V-3	Transmitter Vacuum Tube	Same as V-2	—958A					
*	*	V-4	Transmitter Vacuum Tube	Same as V-2	—958A					
*	*	V-5	Crystal Calibrator Vacuum Tube		—30	JAN-1A	13	30		△P-7707146 P8
*	*	V-6	First Audio-Audio Oscillator Vacuum Tube	Same as V-5	—30					
*	*	V-7	Second Audio-Modulator Vacuum Tube		—1E7G	JAN-1A	16	1E7G		△P-7707146 P7
				CABLES						
	*	W-101	Key Cable	52½″ long						52675-G2
	*	W-201	Headphone-Microphone cable	88″ long						52058-G2
				SOCKETS						
		X-1	Receiver R.F. Tube Socket	Part of Receiver Unit, 5 Contact			21			
	*	X-2	Receiver Detector Tube Socket	5 Contact			21	48601		48601
		X-3	Transmitter Tube Socket	Part of Transmitter Unit			21			
		X-4	Transmitter Tube Socket	Part of Transmitter Unit			21			
	*	X-5	Crystal Calibrator Tube Socket	4 Contact Glazed Ceramic	—49368	RE 49AA 313B	5	SS-4M		51903
	*	X-6	Inter-Stage Audio Tube Socket	4 Contact Bakelite	—49346	RE 49AA 313B	5	S-4M		52087
	*	X-7	Modulator Tube Socket	8 Contact Bakelite	—49351	RE 49AA 313B	5	S-8M		52073
	*	X-8	Crystal Socket	2 Active Contacts Glazed Ceramic. Same as Navy Type —49369 except for missing contacts			5	SS-5M		51904

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.
△Westinghouse Electric & Mfg. Co. Drawing.

TABLE II (cont.)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Mobile Spares	Stock Spares	Sym. Des.	Function	Description	Navy Type No.	Navy Dwg. or Spec.	M F R	Mfr. Desig.	Special Tol. Rating or Modification	Contractor's Drawing and Part No.
				CRYSTAL						
	*	Y-1	Crystal	5000 KC. ±.02% at 20° C. Temperature coefficient not more than 5 parts per million per degree C.			10	Type MO-2 Holder or Equivalent		△T-7606438 P134
				MISCELLANEOUS						
*			Battery Pack	Tropical Construction, rated voltage common terminal to terminal A1, +3.0 volts; A2, +1.5 volts; B, +156 volts; C, −7.5 volts	−19018B	RE 13A 603D	18			52060
			Shipping Chest	Metal bound, fibre covered, ⅜" plywood chest	−10197		23			52011
	*		Canvas Carrying Case		−10039B		17			51932
*	*		Antenna (Ten Sections)	Assembled (All Sections); 9 ft. long. Stainless steel seamless tubing	−66087		27	50540		48536
				Assembled (All Sections); 9 ft. long. Monel seamless tubing.	−66087-S		2			52502
	*		Antenna Mounting Assembly							48567
	*		Cap and Chain Assembly	Cap for external Antenna receptacle, J4			5	9760-10		48748
*			Insulator	Antenna Mounting			28			52031
*			Insulating Spacer	Antenna feed-through bushing			29			52032
	*		Grid Clip	Parts			13	9939	△M-7406930 P10	△T-7606438 P133
*			Spring Transmitter Tuning Drive, Anti-Backlash	Small Coil Spring			31			△T-7606436 P123
	*		Tube Clip	Socket Parts			21			48574
	*		Wrench-Set Screw	Bristol #6			34			51935
	*		Terminals	Meter			35	2109		51924

*Spare Parts Furnished, Refer to Spare Parts List for Quantities.
△Westinghouse Electric & Mfg. Co. Drawing.

TABLE III

PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBY-8 RADIO TRANSMITTING-RECEIVING EQUIPMENT

Quantity	Navy Type Number	All Symbol Designations Involved
MISCELLANEOUS CLASS 10		
1	−10039B	
1	−10197	
1	−19018B	
1	−66087 or −66087-S	
ELECTRICAL INDICATING INSTRUMENTS CLASS 22		
1		M-1
SWITCHES CLASS 24		
2		S-1, S-2
1		S-3
3		S-4, S-6, S-9
1		S-5
1		S-101
RELAY CLASS 29		
1	−29230	K-1
AF TRANSFORMERS AND REACTORS CLASS 30		
1		T-1
1		T-2
1		T-3
VACUUM TUBES CLASS 38		
1	−1E7G	V-7
2	−30	V-5, V-6
3	−958A	V-2, V-3, V-4
1	−959	V-1
CRYSTALS CLASS 40		
1		Y-1
RF TRANSFORMERS AND INDUCTORS CLASS 47		
1		L-1
1		L-2
1		L-3
1		L-4
1		L-5
1		L-6
1		L-7
1		L-8
1		L-9
1		L-10
1		L-11
1		L-12
1		L-13
1		L-14
1		L-15
1		L-16
1		L-17
CAPACITORS CLASS 48		
2	−48674-B10	C-7, C-29
3	−48691-B10	C-17, C-18, C-22
1	−48712-B	C-28
1	−48783-B10	C-19
4	−48847-B10	C-8, C-10, C-12, C-25
2	−48856-B10	C-5, C-30
2	−48895-B10	C-15, C-16
3	−48983-B10	C-20, C-26, C-27
4	−481036-B10	C-3, C-4, C-9, C-11
1	−481037-B10	C-24
1		C-1
1		C-2
1		C-6
1		C-13
1		C-14
1		C-21
PLUGS AND SOCKETS CLASS 49		
1	−49194	J-4
1	−49346	X-6
PLUGS AND SOCKETS (Cont.) CLASS 49		
1	−49351	X-7
1	−49368	X-5
1	−49369	X-8
2		J-1, J-2
1		J-3
1		P-1
1		P-101
1		P-201
1		X-1
1		X-2
1		X-3
1		X-4
CABLES CLASS 62		
1		W-101
1		W-201
RESISTORS CLASS 63		
1	−66360	R-3
1	−66360	R-4
1	−66360	R-13
1	−66360	R-6
3	−66360	R-10, R-12, R-16
1	−66360	R-23
1	−66360	R-5
1	−66360	R-21
1	−66360	R-22
2	−66360	R-1, R-2
1	−63678-2	R-9
1	−63678-2	R-19
1	−63678-2	R-18
1	−63678-5	R-20
1	−63678-10	R-11
1		R-7
1		R-8
1		R-14
1		R-15
1		R-17

TABLE IV

SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBY-8 TRANSMITTING-RECEIVING EQUIPMENT

Quan. Mobile Spares	Quan. Stock Spares	Navy Type Number	All Symbol Designations Involved	Description	M F R	Mfr. Desig.	Contractor's Drawing and Part Number	Field Record Quan. Issued
				MISCELLANEOUS (Class 10)				
	5	−10039B		Canvas Carrying Case	17		51932	
2		−19018B		Battery Pack	18		52060	
	25			Tube Clip	21	48574	48574	
	10			Grid Clip	13	#9939	△T-7606438 P133	
	5			Receptacle and Cap Assembly	2	51911	51911	
	5			Antenna Mounting Assembly	2	48567	48567	
2				Spring—Transmitter Tuning Drive, Anti-backlash	31		△T-7606436 P123	
	45			Washer—Neoprene			52046	
	20			Washer—Neoprene			48749	
1				Chart—Rec. Band 4	2	MX40-P9	MX40-P9	
1				Chart—Trans. Band 4	2	MX40-P13	MX40-P13	
1				Chart—Rec. Band 3	2	MX40-P10	MX40-P10	
1				Chart—Trans. Band 3	2	MX40-P14	MX40-P14	
1				Chart—Rec. Band 2	2	MX40-P11	MX40-P11	
1				Chart—Trans. Band 2	2	MX40-P15	MX40-P15	
1				Chart—Rec. Band 1	2	MX40-P12	MX40-P12	
1				Chart—Trans. Band 1	2	MX40-P16	MX40-P16	
	5			Wrench-Set Screw-Bristol #6	34		51935	
	10			Terminals	35	2109	51924	
				ELECTRICAL INDICATING INSTRUMENTS (Class 22)				
	5		M-1	Milliammeter, 0 to 5 milliamps, full scale. Scale to be blank except for 1/8" wide mark at mid-scale and a zero adjustment line. Pointer and mid-scale to be luminous with non-glare glass dial. Background to be black	4	NX-33	51914	
				SWITCHES (Class 24)				
	15		S-4, S-6, S-9	Double-pole, double-throw, 6 amps. at 125 volts A.C., 11/32" bushing, toggle type, assembled with cover	2		52006	

△Westinghouse Electric & Mfg. Co. Drawing.

SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBY-8 TRANSMITTING-RECEIVING EQUIPMENT

Quan. Mobile Spares	Quan. Stock Spares	Navy Type Number	All Symbol Designations Involved	Description	MFR	Mfr. Desig.	Contractor's Drawing and Part Number	Field Record Quan. Issued
				SWITCHES (Class 24)—Continued				
	5		S-5	Double-pole, three-position, rotary type, assembled with cover	2		52004	
			S-101	See Class 26				
				KEYS (Class 26)				
	5	—26013B		Key, cord and plug assembly	19		48527-G2	
				RELAY (Class 29)				
	5	—29230	K-1	Transfer relay, five-pole double-throw, to operate under normal voltage 3.0, minimum voltage 2.0, max. current 0.125 amp. contacts:	14	#C-11943	52515	
		—29230		B—one make and break (S.P.D.T.) C—one make and break (S.P.D.T.) D—one make and break (S.P.D.T.) E—one make F—one make and break (S.P.D.T.) All contacts insulated		19890	52529	
				TRANSFORMERS (Class 30)				
	5		T-1	Audio input transformer. Primary 3000 turns; Secondary S-1, 6000 turns; S-2, 2000 turns	9	48689	48689	
	5		T-2	Audio interstage transformer. Primary P-1, 2900 turns; P-2, 216 turns; Secondary 7100 turns	9	48690	48690	
	5		T-3	Modulation transformer. Primary 5000 turns; Secondary S-1, 750 turns; S-2, 3000 turns	9	48691	48691	
				VACUUM TUBES (Class 38)				
2	10	—30	V-5, V-6	Tube, Audio Amplifier	13	30	△P-7707146 P8	
1	5	—1E7G	V-7	Tube, Audio Amplifier	16	1E7G	△P-7707146 P7	
3	15	—958A	V-2, V-3, V-4	Tube, Oscillator and Detector	13	958A	△P-7707146 P5	
1	5	—959	V-1	Tube, R.F. Amplifier	13	959	△P-7707146 P6	

△Westinghouse Electric & Mfg. Co. Drawing.

TABLE IV (cont.)

SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBY-8 TRANSMITTING-RECEIVING EQUIPMENT

Quan. Mobile Spares	Quan. Stock Spares	Navy Type Number	All Symbol Designations Involved	Description	MFR	Mfr. Desig.	Contractor's Drawing and Part Number	Field Record Quan. Issued
				CRYSTALS (Class 40)				
	5		Y-1	Crystal, 5000 Kc. ± .02% at 20° C. Temperature coefficient not more than 5 parts per million per degree C.	10	Type MO-2 Holder or Equivalent	△T-7606438 P134	
				INDUCTORS AND R. F. CHOKES (Class 47)				
	5		L-10	60 turns, center tapped, #31 D.S.C. wire on ¼" form	21	48541	48541	
	5		L-11	2.1 millihenries, 35 ohms, 1 MMF., 125 milliamps	21	48540	48540	
	5		L-12	250 millihenries, 575 ohms, 50 milliamps	21	MX-78	MX-78	
	5		L-13	44 turns, #25 D.S.C. wire, 1" long x ¼" O. D.	21	48542	48542	
	5		L-14	20.1 microhenries, #31 D.S.C. wire, 1 1/16" long x ⅜" O. D.	21	48537	48537	
				CAPACITORS (Class 48)				
	5	−481036-B10	C-3, C-4, C-9, C-11	0.003 MFD., 500 V.D.C. Working, Mica	1 15 21 37	1-WLS #1467 LS AMT C	48649	
	5	−48856-B10	C-5, C-30	0.002 MFD., 500 V.D.C. Working, Mica	1 15 21 37	1-WLS #1467 LS AMT C	48646	
	5	−48674-B10	C-7, C-29	0.0001 MFD., 500 V.D.C. Working, Mica	1 15 21 37	5-WLS #1468 LS EMT D	48642	
	5	−48847-B10	C-8, C-10, C-12, C-25	0.006 MFD., 300 V.D.C. Working, Mica	1 15 21 37	1-WLS #1467 LS AMT C	48651	
	5	−48895-B10	C-15, C-16	0.00005 MFD., 500 V.D.C. Working, Mica	1 15 21 37	5-WLS #1468 LS EMT D	48623	
	5	−48691-B10	C-17, C-18, C-22	0.0005 MFD., 500 V.D.C. Working, Mica	1 15 21 37	5-WLS #1468 LS ME T D	48643	
	5	−48783-B10	C-19	0.00002 MFD., 500 V.D.C. Working, Mica	1 15 37	5-WLS #1468 LS D	48621	
	5	−48983-B10	C-20, C-26, C-27	0.001 MFD., 500 V.D.C. Working, Mica	1 15 37	1-WLS #1467 LS C	48645	

△Westinghouse Electric & Mfg. Co. Drawing.

SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBY-8 TRANSMITTING-RECEIVING EQUIPMENT

Quan. Mobile Spares	Quan. Stock Spares	Navy Type Number	All Symbol Designations Involved	Description	M F R	Mfr. Desig.	Contractor's Drawing and Part Number	Field Record Quan. Issued
				CAPACITORS (Class 48)—Continued				
	5		C-21	0.1 MFD., 400 V.D.C. Working, Molded Paper	24	Type 345	48652	
	5	—481037-B10	C-24	0.005 MFD., 300 V.D.C. Working, Mica	1 15 37	1-WLS #1467 LS C	48650	
	5	—48712-B	C-28A, C-28B	0.1-0.1 MFD., 600 V.D.C. Working, Paper	1 15	Dyr-6011-2 #630	48653	
				RECEPTACLES, PLUGS AND SOCKETS (Class 49)				
	5		P-1	Power Plug, 5 Prongs	5	#RCP5	51926	
	5		J-1, J-2	Headphone and Microphone Plug Receptacle—4 Contacts	5	#91-501	52538	
	5		J-3	Key Plug Receptacle—4 Contacts	5	#91-502	52539	
			P-101	See Class 62				
			P-201	See Class 62				
	5		X-2	Socket—5 Contacts	21	48601	48601	
	5	—49368	X-5	Socket—4 Contacts	5	SS-4-M	51903	
	5	—49346	X-6	Socket—4 Contacts	5	S-4-M	52087	
	5	—49351	X-7	Socket—8 Contacts	5	S-8-M	52073	
	5		X-8	Socket, 2 Active Contacts, same as Navy Type —49369 except for missing contacts	5	SS-5-M	51904	
				HEADPHONE, MICROPHONE, COMBINATION HANDSETS (Class 51)				
	5	—51022-B or —51022-C		Headphone—Microphone Cord and Plug Assembly	30		52062-G2 52062-G3	
				INSULATORS (Class 61)				
1				Antenna Mounting Insulator	28		52031	
1				Insulating Spacer	29		52032	

SPARE PARTS LIST BY NAVY TYPE NUMBERS FOR MODEL TBY-8 TRANSMITTING-RECEIVING EQUIPMENT

Quan. Mobile Spares	Quan. Stock Spares	Navy Type Number	All Symbol Designations Involved	Description	MFR	Mfr. Desig.	Contractor's Drawing and Part Number	Field Record Quan. Issued
				CABLES (Class 62)				
	5		W-101, P-101	Key Cable, 52½″ long, complete with plug	30		52675-G4	
	5		W-201, P-201	Microphone Cable, 88″ long, complete with plug	30		52058-G4	
				RESISTORS AND POTENTIOMETERS (Class 63)				
	5	−63360	R-1, R-2	1 megohm ±10%, ½ watt, insulated	25	EB-½	52549	
	5	−63360	R-3	100 ohms ±10%, ½ watt, insulated	6 25 26	BT-½ EB-½ MB-½	48734	
	5	−63360	R-4	5000 ohms ±10%, ½ watt, insulated	6	BT-½	△T-7606438 P82	
	5	−63360	R-5	100,000 ohms ±10%, ½ watt, insulated	6	BT-½	△T-7606438 P83	
	5	−63360	R-6	20,000 ohms ±10%, ½ watt, insulated	6	BT-½	△T-7606438 P84	
	5		R-7	500,000 ohms ±10%, composition, ½ watt, logarithmic taper	6	Type CS Taper "C"	48785	
	5		R-8	500,000 ohms ±10%, composition, ½ watt, linear taper	6	Type CS Taper "A"	48784	
	5	−63678-2	R-9	14 ohms ±2%, ½ watt, wire wound, insulated	6	BW-½	△T-7606438 P87	
	5	−63360	R-10, R-12, R-16	50,000 ohms ±10%, ½ watt, insulated	6	BT-½	48735	
	5	−63678-10	R-11	100 ohms ±10%, ½ watt, wire wound, insulated	6	BW-½	△T-7606438 P89	
	5	−63360	R-13	10,000 ohms ±10%, ½ watt, insulated	6	BT-½	△T-7606438 P91	
	10		R-14, R-15	3.6 ohms, 0.6 amp., wire wound, linear	22	252	48758	
	5		R-17	.625 ohm +2%, −7½%, ½ watt, non-insulated	12	Type 506	△T-7606438 P95	
	5	−63678-2	R-18	800 ohms ±2%, ½ watt, wire wound, insulated	6	BW-½	△T-7606438 P96	
	5	−63678-2	R-19	535 ohms ±2%, ½ watt, wire wound, insulated	6	BW-½	△T-7606438 P97	
	5	−63678-5	R-20	25 ohms ±5%, ½ watt, wire wound, insulated	6	BW-½	△T-7606438 P98	
	5	−63360	R-21	200,000 ohms ±10%, ½ watt, insulated	6	BT-½	△T-7606438 P99	
	5	−63360	R-22	250,000 ohms ±10%, ½ watt, insulated	6	BT-½	△T-7606438 P100	
	5	−63360	R-23	75,000 ohms ±10%, ½ watt, insulated	6	BT-½	△T-7606438 P101	
				ANTENNA SYSTEM (Class 66)				
1	5	−66087 or 66087-S		Antenna Assembly	27		48536 52502	

△Westinghouse Electric & Mfg. Co. Drawing.

TABLE V

APPLICABLE COLOR CODES AND MISCELLANEOUS DATA FOR MODEL TBY 8 TRANSMITTING-RECEIVING EQUIPMENT

RMA STANDARD COLOR CODE FOR RESISTORS IN OHMS AND CAPACITORS IN M. M. F.

A. Color for 1st significant figure.

B. Color for 2nd significant figure.

C. Color for number of ciphers or multiplier.

D. Gold or silver indicates tolerance, when applied.

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1,000
Yellow	4	10,000
Green	5	100,000
Blue	6	1,000,000
Violet	7	10,000,000
Gray	8	100,000,000
White	9	1,000,000,000
Gold	±5% Tolerance	0.1
Silver	±10% Tolerance	0.01
No Color	±20% Tolerance	

EXAMPLES

43,000 ohms	Yellow (4)	Orange (3)	Orange (X1000)
3,000 ohms	Orange (3)	Black (0)	Red (X100)
3.3 ohms	Orange (3)	Orange (3)	Gold (0.1)

TABLE VI

INDEX TO MANUFACTURERS

Code No.	Mfr. Prefix	Name	Address
1	CD	Cornell-Dubilier Elect. Corp.	So. Plainfield, N. J.
2	CRI	Colonial Radio Corp.	254 Rano St., Buffalo, N. Y.
3	CQA	Astatic Corp.	Youngstown, Ohio
4	CAY	Westinghouse Electric and Mfg. Co.	2519 Wilkens Ave., Baltimore, Md.
5	CPH	American Phenolic	1830 S. 54th St., Chicago, Ill.
6	CIR	International Resistance Co.	401 North Broad St., Philadelphia, Pa.
7	CMA	P. R. Mallory Co., Inc.	Indianapolis, Indiana
8	CAE	Cutler-Hammer Co.	12th and St. Paul Ave., Milwaukee, Wis.
9	CAT	American Transformer Co.	178 Emmett St., Newark, N. J.
	CRW	Rola Mfg. Co.	Cleveland, Ohio
10	CQB	Bliley Electric Co.	Union Station Bldg., Erie, Pa.
		HiPower Crystal Co.	205 W. Wacker Drive, Chicago, Ill.
11	CHH	Hart and Hegeman	Hartford, Conn.
12	CER	Erie Resistor Corp.	Erie, Pennsylvania
13	CRC	R. C. A. Radiotron Corp.	Harrison, New Jersey
14	CRY	C. P. Clare and Co.	4719 Sunnyside Ave., Chicago, Illinois
15	CAW	Aerovox Corp.	New Bedford, Mass.
16	CHS	Hygrade Sylvania Corp.	Clifton, New Jersey
17	CSS	F. M. Stevenson Co.	412 E. Pratt St., Baltimore, Maryland
18	CNC	National Carbon Co.	Cleveland, Ohio
	CGD	General Dry Batteries Inc.	Cleveland, Ohio
19	CRH	A. E. Rittenhouse Co., Inc.	Honeoye Falls, New York
20	CMO	Miller Rubber Co.	1247 S. High St., Akron, Ohio
21	CFW	F. W. Sickles Co.	Springfield, Mass.
22	CTC	Chicago Telephone Supply Co.	Elkhart, Indiana
23	CFG	Fisher-Price Toys Inc.	East Aurora, New York
24	CMB	Micamold Radio Corp.	1087-1095 Flushing Ave., Brooklyn, N. Y.
25	CBZ	Allen Bradley Co.	118 West Greenfield Ave., Milwaukee, Wis.
26	CSA	Stackpole Carbon Co.	St. Marys, Pa.
27	CWN	Winters and Crampton Corp.	Grandville, Mich.
28	CZP	Plastimold Corp.	Attleboro, Mass.
29		Watertown Mfg. Co.	3 Porter St., Watertown, Conn.
30	CTE	Telephonics Corporation	350 W. 31st St., New York, N. Y.
31		American Spring Company	200 Elm St., Holly, Mich.
32	CEX	Emerson Radio & Phonograph Corp.	111 8th Ave., New York City, N. Y.
33		Precision Fabricators	P.O. Box 290, Rochester, N. Y.
34	CTB	The Bristol Company	Waterbury, Conn.
35		Shakeproof, Inc.	2501 N. Keeler Ave., Chicago, Ill.
36		General Electric Company	Bridgeport, Conn.
37		Sangamo Electric Co.	Springfield, Ill.
38		Electro-Motive Mfg. Co.	Willimantic, Conn.
39	CAFA	R. B. M. Mfg. Co.	Logansport, Indiana

Fig. 1—Navy Model TBY-8 Equipment Composite View

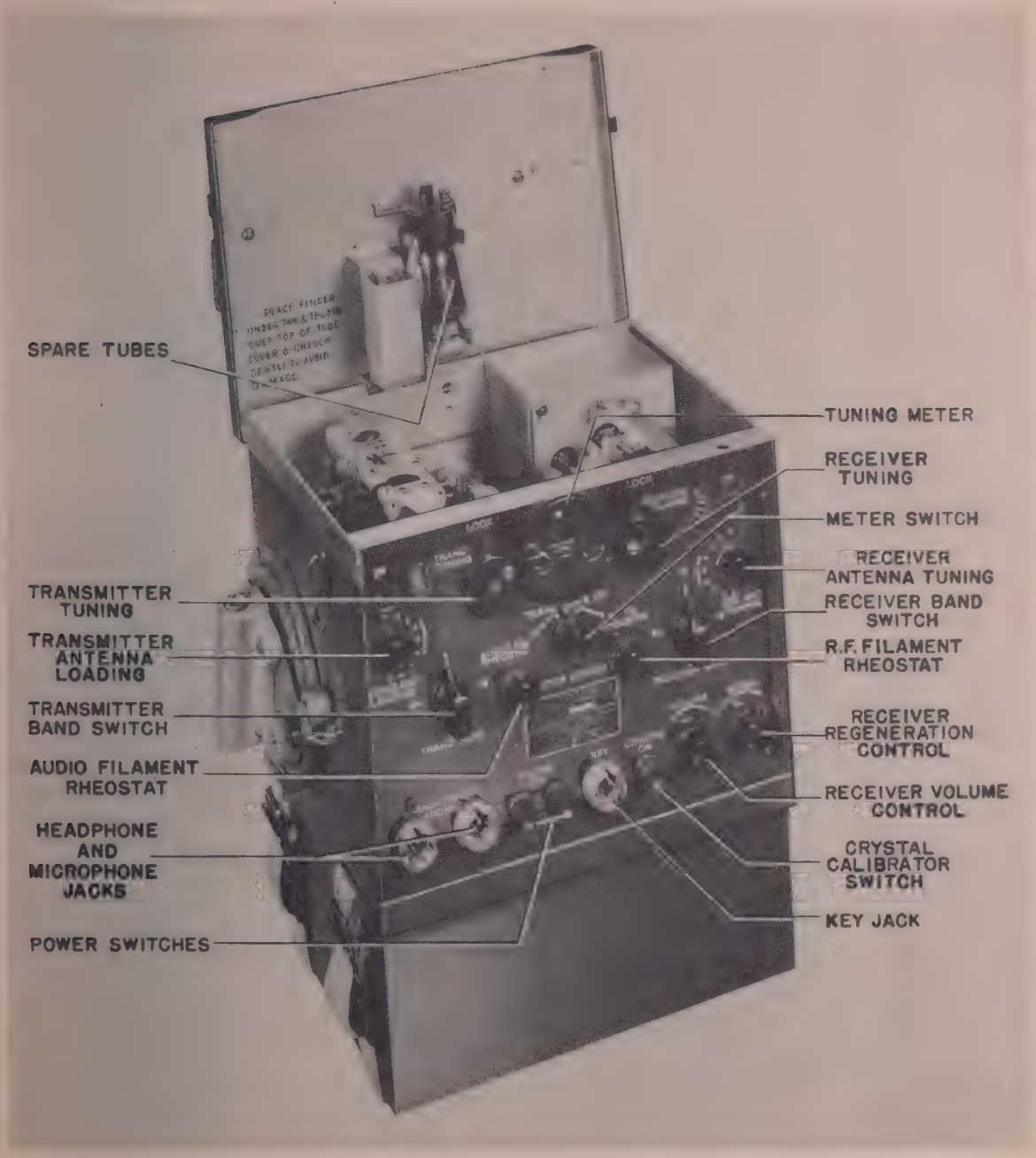


Fig. 2—Transmitter-Receiver Unit, Navy Type CRI-43044, Front View

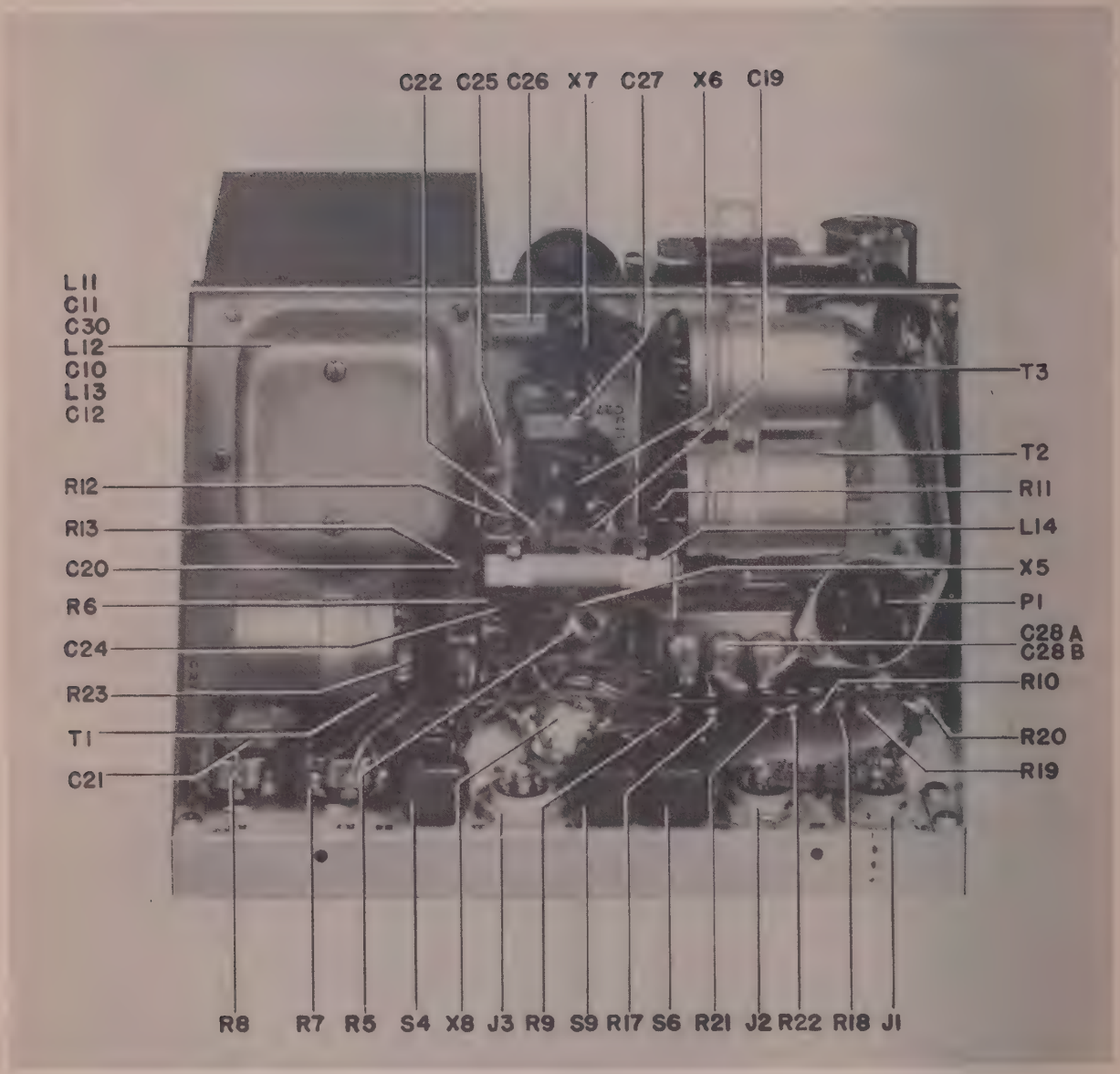


Fig. 3—Transmitter-Receiver Unit, Navy Type CRI-43044, Chassis Removed from Case, Bottom View

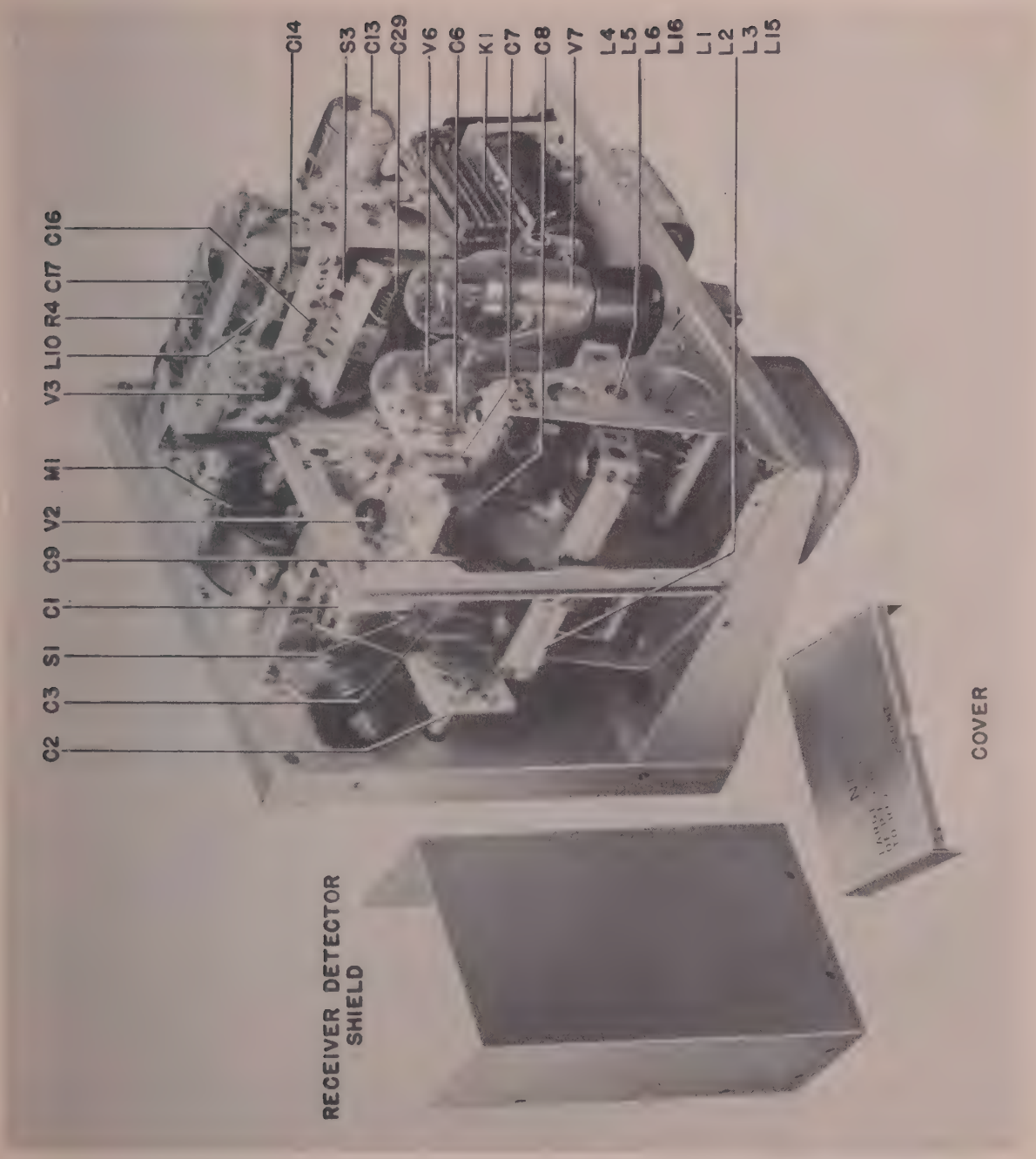


Fig. 4—Transmitter-Receiver Unit, Navy Type CRI-43044, Chassis Removed from Case, Rear from Right Side

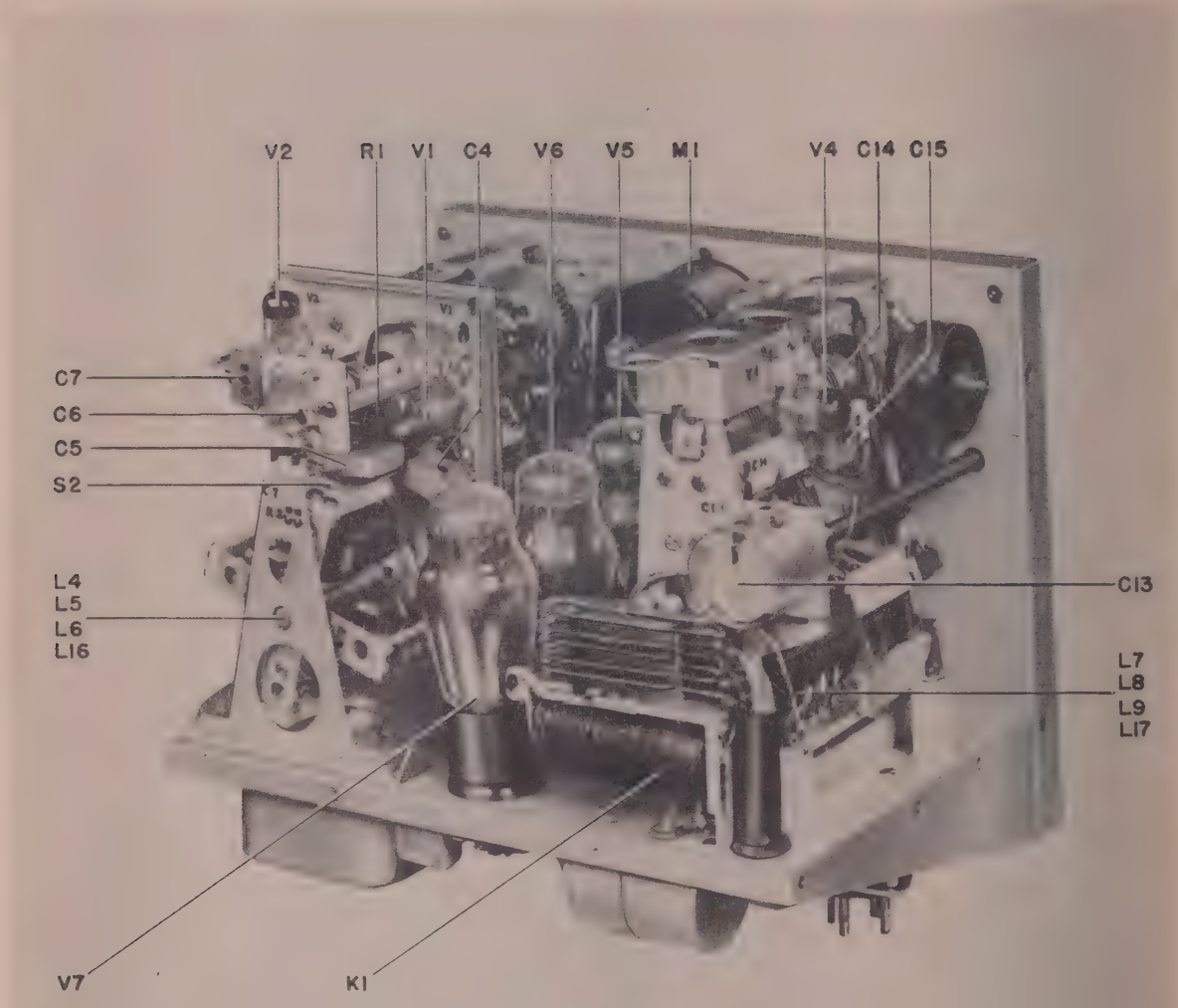


Fig. 5—Transmitter-Receiver Unit, Navy Type CRL-43044, Chassis Removed from Case, Rear from Left Side

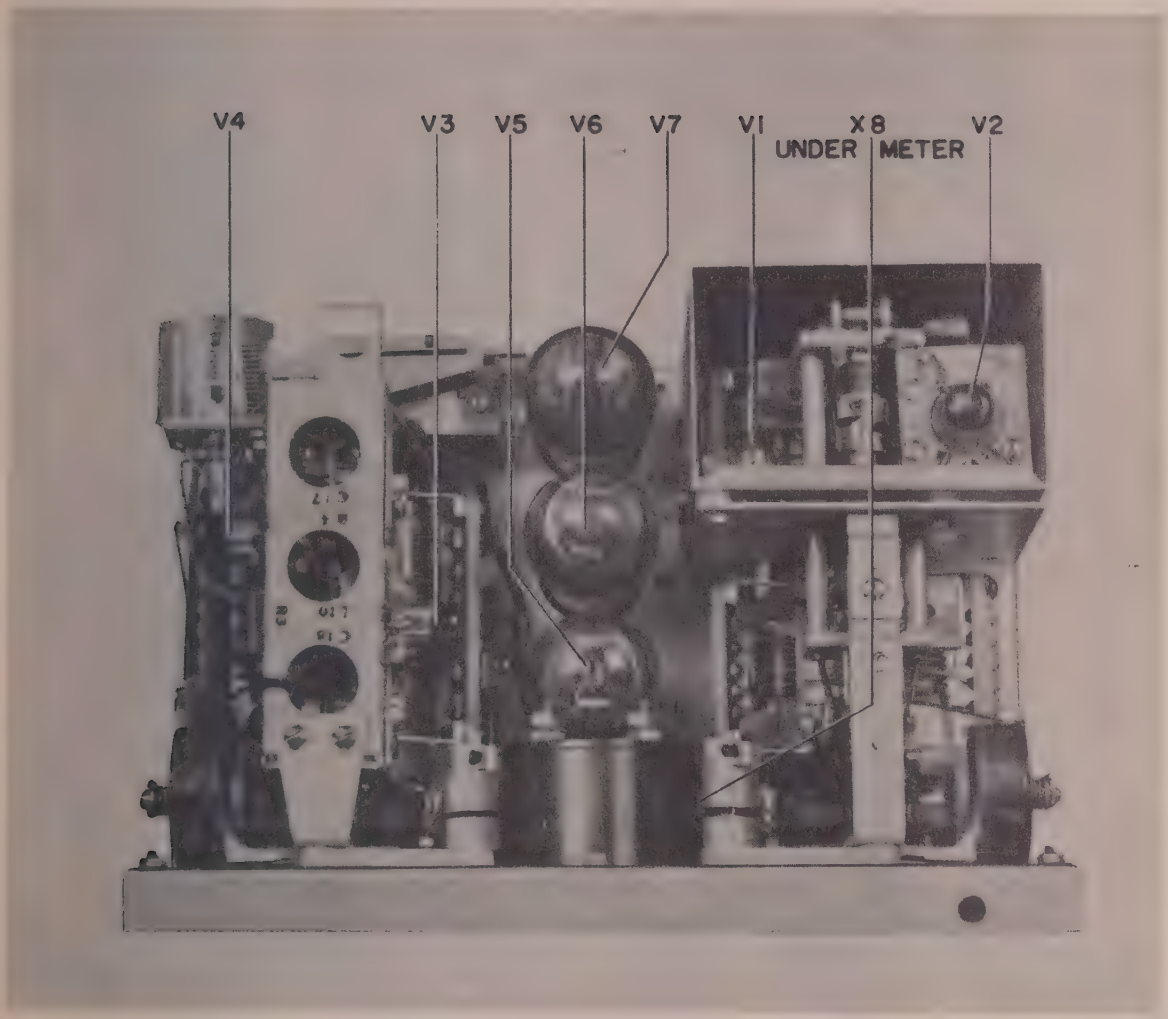


Fig. 6—Transmitter-Receiver Unit, Navy Type CRI-43044, Chassis Removed from Case, Top View

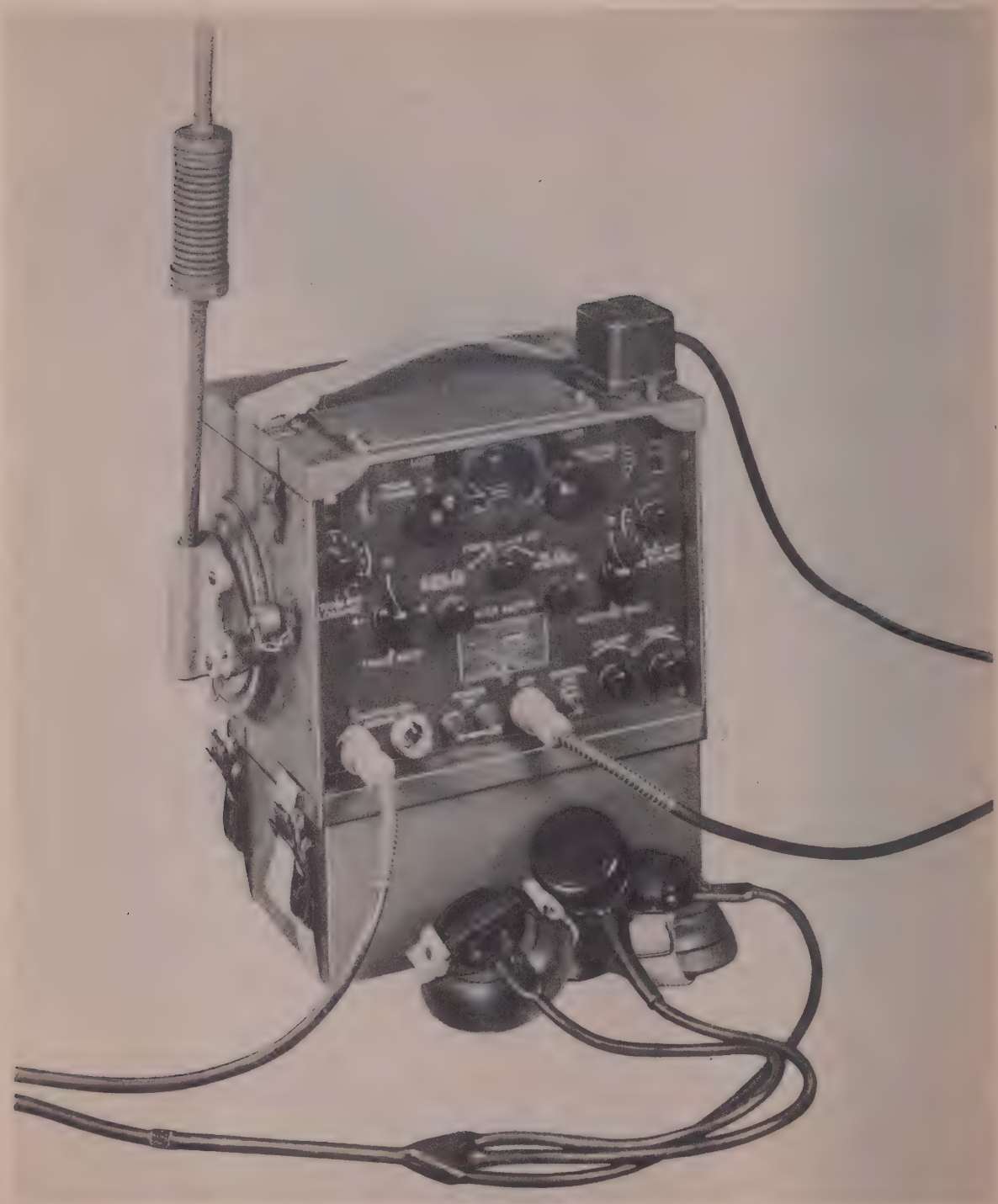


Fig. 7—Navy Model TBY-8 Equipment Assembled for Field Operation

Fig. 8—Navy Model TBY-8 Equipment Assembled for Operation on a Man's Back

Fig. 9—Navy Model TBY-8 Equipment Packed in Shipping Chest, Navy Type CFG-10197, Cover Open

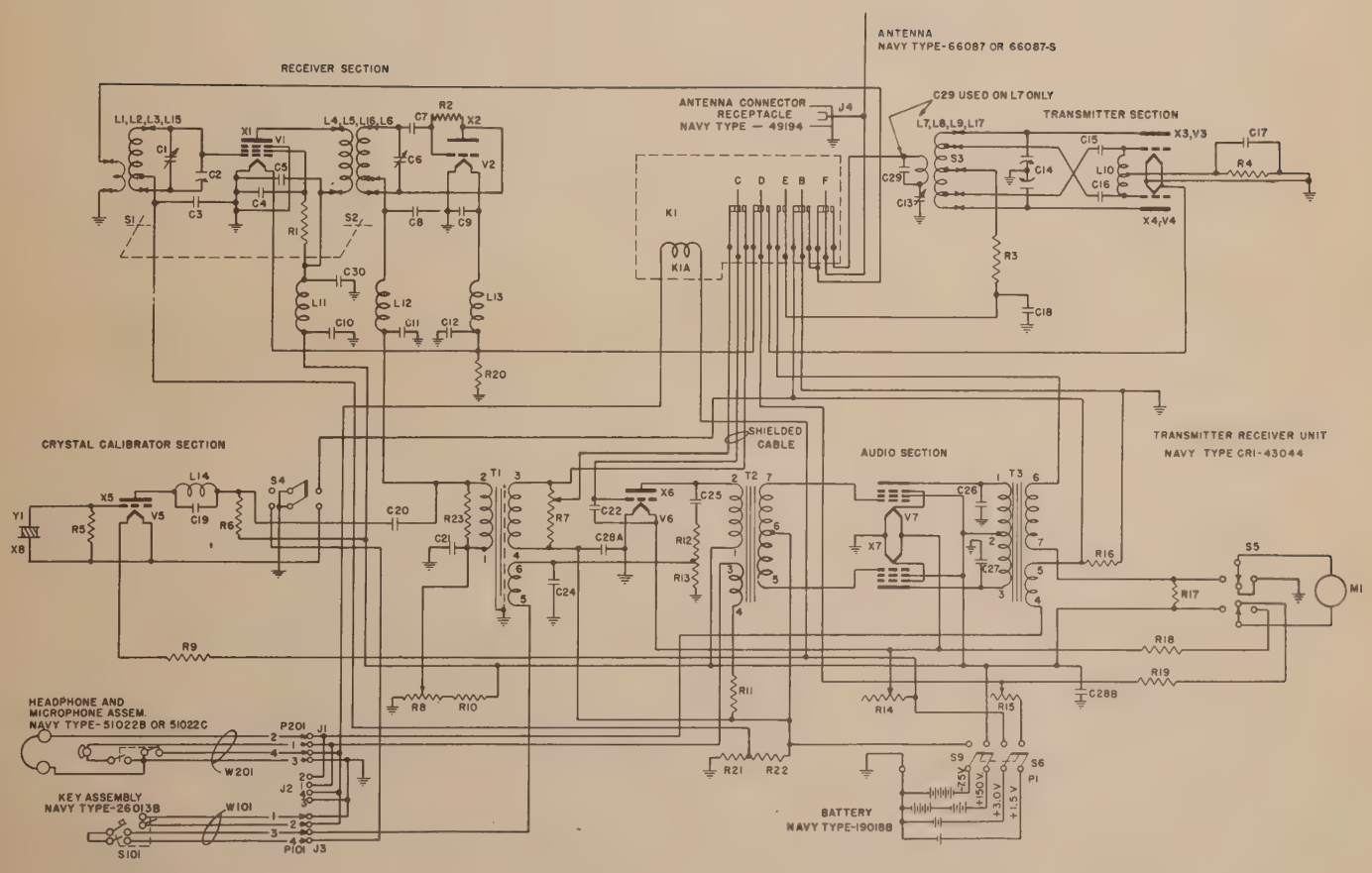
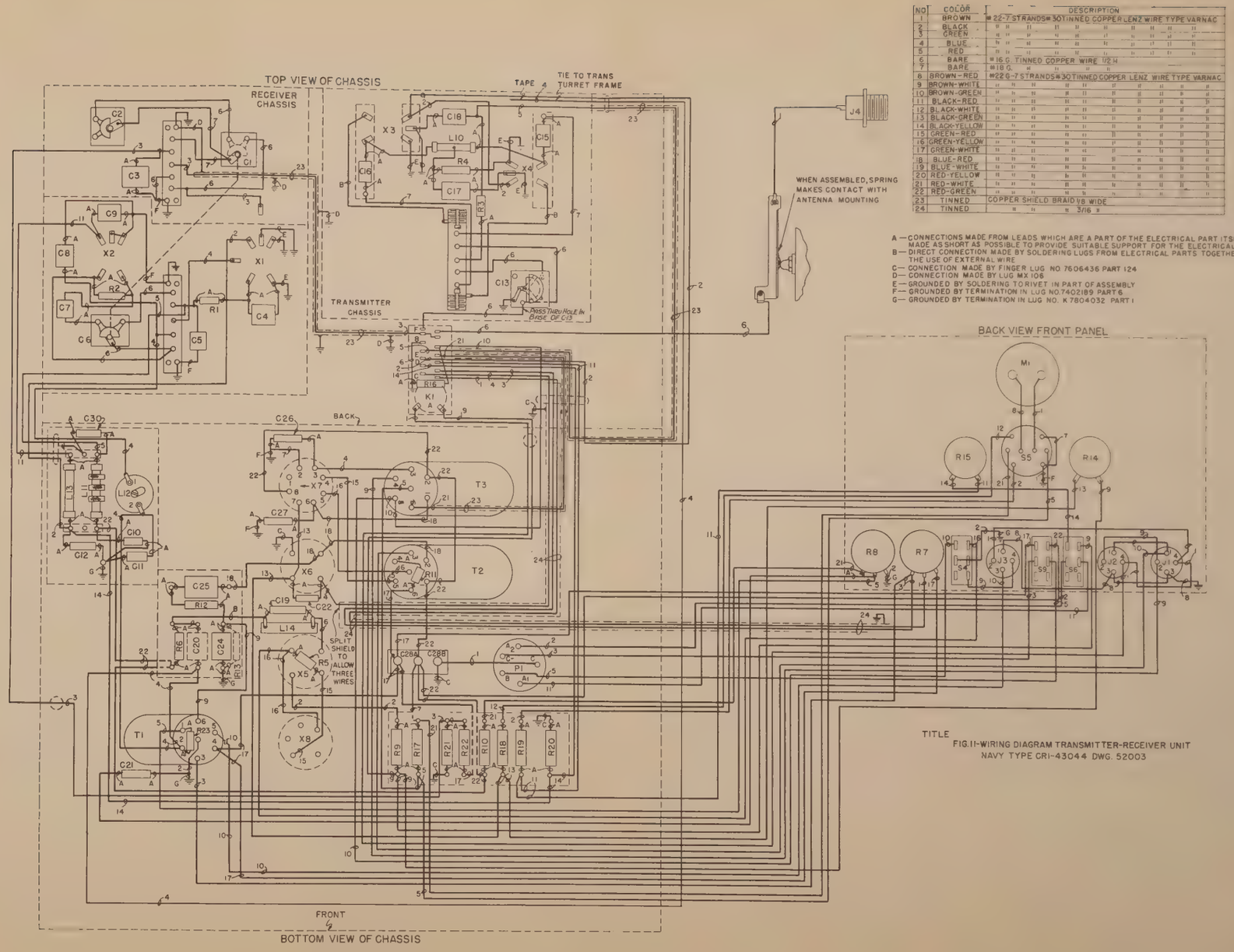


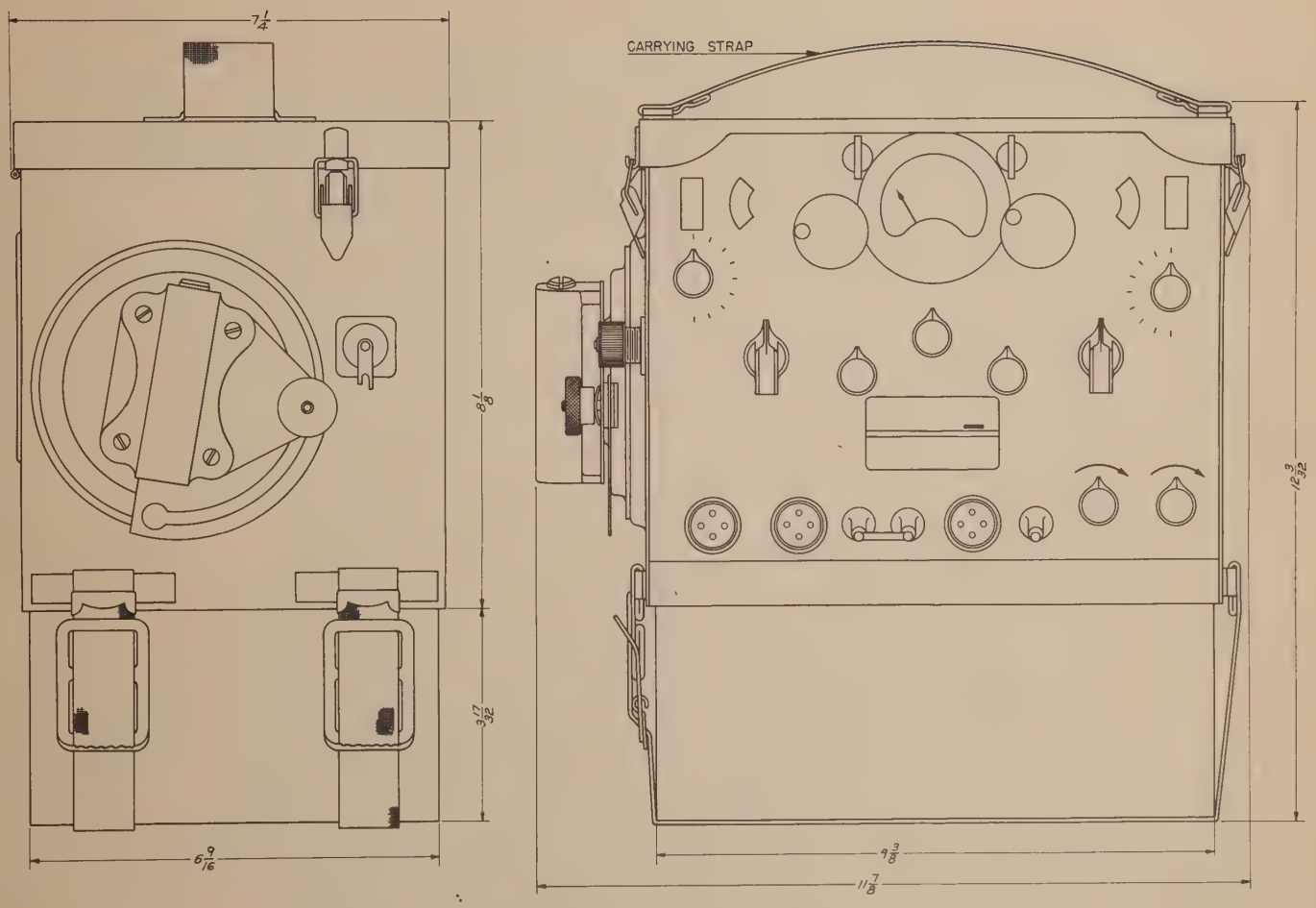
Fig. 10—Schematic Diagram, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52513



NO	COLOR	DESCRIPTION
1	BROWN	#22-7 STRANDS #30 TINNED COPPER LENZ WIRE TYPE VARNAC
2	BLACK	" " " " " " " " " "
3	GREEN	" " " " " " " " " "
4	BLUE	" " " " " " " " " "
5	RED	" " " " " " " " " "
6	BARE	#16 G. TINNED COPPER WIRE 1/2 H
7	BARE	#18 G. " " " "
8	BROWN-RED	#22 G-7 STRANDS #30 TINNED COPPER LENZ WIRE TYPE VARNAC
9	BROWN-WHITE	" " " " " " " " " "
10	BROWN-GREEN	" " " " " " " " " "
11	BLACK-RED	" " " " " " " " " "
12	BLACK-WHITE	" " " " " " " " " "
13	BLACK-GREEN	" " " " " " " " " "
14	BLACK-YELLOW	" " " " " " " " " "
15	GREEN-RED	" " " " " " " " " "
16	GREEN-YELLOW	" " " " " " " " " "
17	GREEN-WHITE	" " " " " " " " " "
18	BLUE-RED	" " " " " " " " " "
19	BLUE-WHITE	" " " " " " " " " "
20	RED-YELLOW	" " " " " " " " " "
21	RED-WHITE	" " " " " " " " " "
22	RED-GREEN	" " " " " " " " " "
23	TINNED	COPPER SHIELD BRAID 1/8 WIDE
24	TINNED	" " " 3/16 "

Fig. 11—Wiring Diagram, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52003

Fig. 11—Wiring Diagram, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52003



TRANSMITTER-RECEIVER UNIT COMPLETE WITH CRYSTAL CALIBRATOR
PART OF MODEL TBY 8 EQUIPMENT
ULTRA-PORTABLE OR PACK TYPE EQUIPMENT FOR TWO WAY COMMUNICATION
BY EITHER VOICE (TELEPHONE) OR MCW (TELEGRAPHY)
FREQUENCY RANGE 28 TO 80 MEGACYCLES
POWER OUTPUT - 1/2 WATT
WEIGHT INCLUDING BATTERY-APPROX. 33.7 LBS.
WEIGHT EXCLUDING BATTERY - APPROX. 20.2 LBS.

Fig. 12—Outline Drawing, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52682

Fig. 12—Outline Drawing, Transmitter-Receiver Unit, Navy Type CRI-43044, Drawing 52682

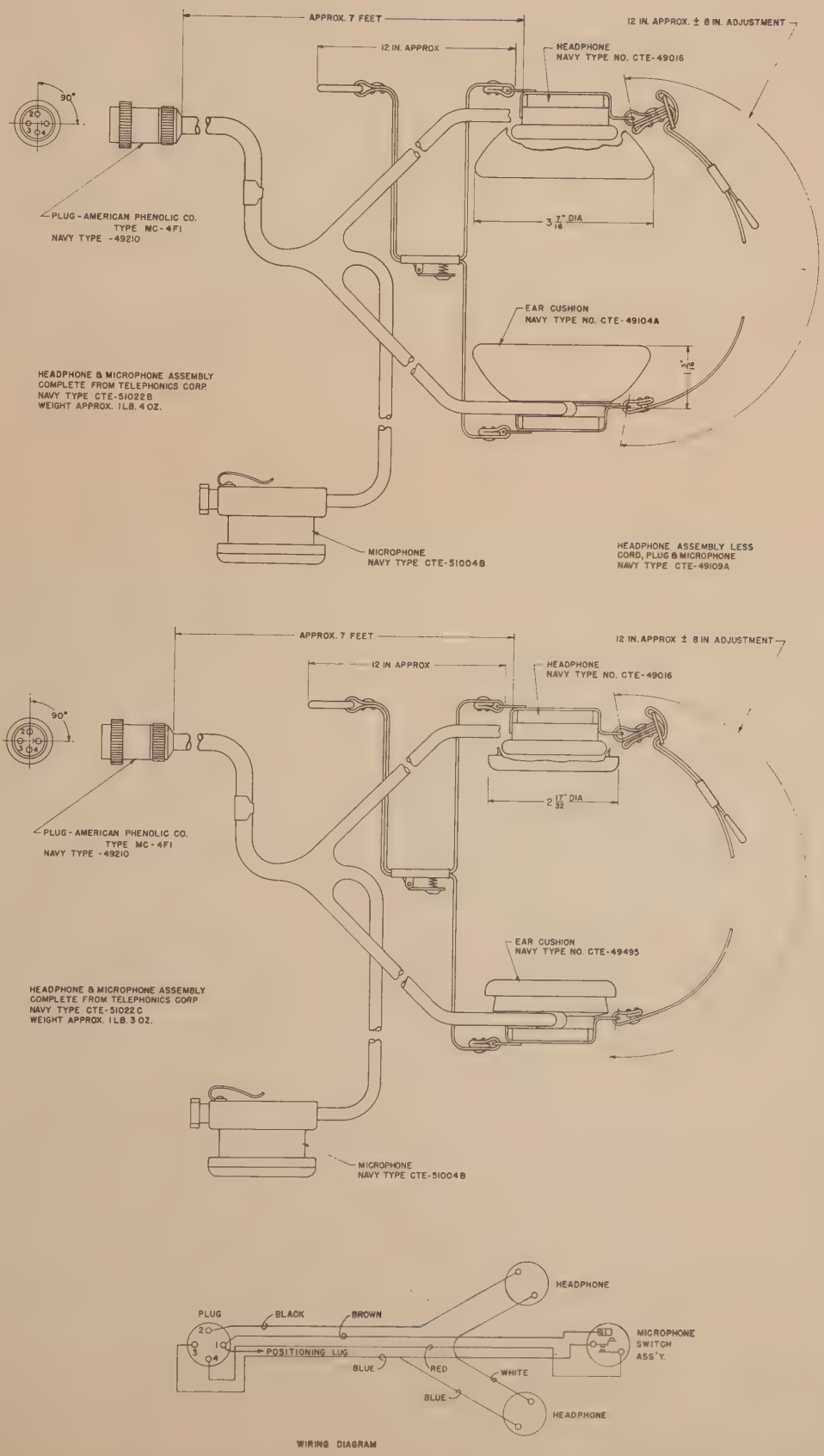


Fig. 13—Outline Drawing and Wiring Diagram, Headphone and Microphone Assembly, Navy Type CTE-51022B or CTE-51022C, Drawing 52702

Fig. 13—Outline Drawing and Wiring Diagram, Headphone and Microphone Assembly, Navy Type CTE-51022B or CTE-51022C, Drawing 52702

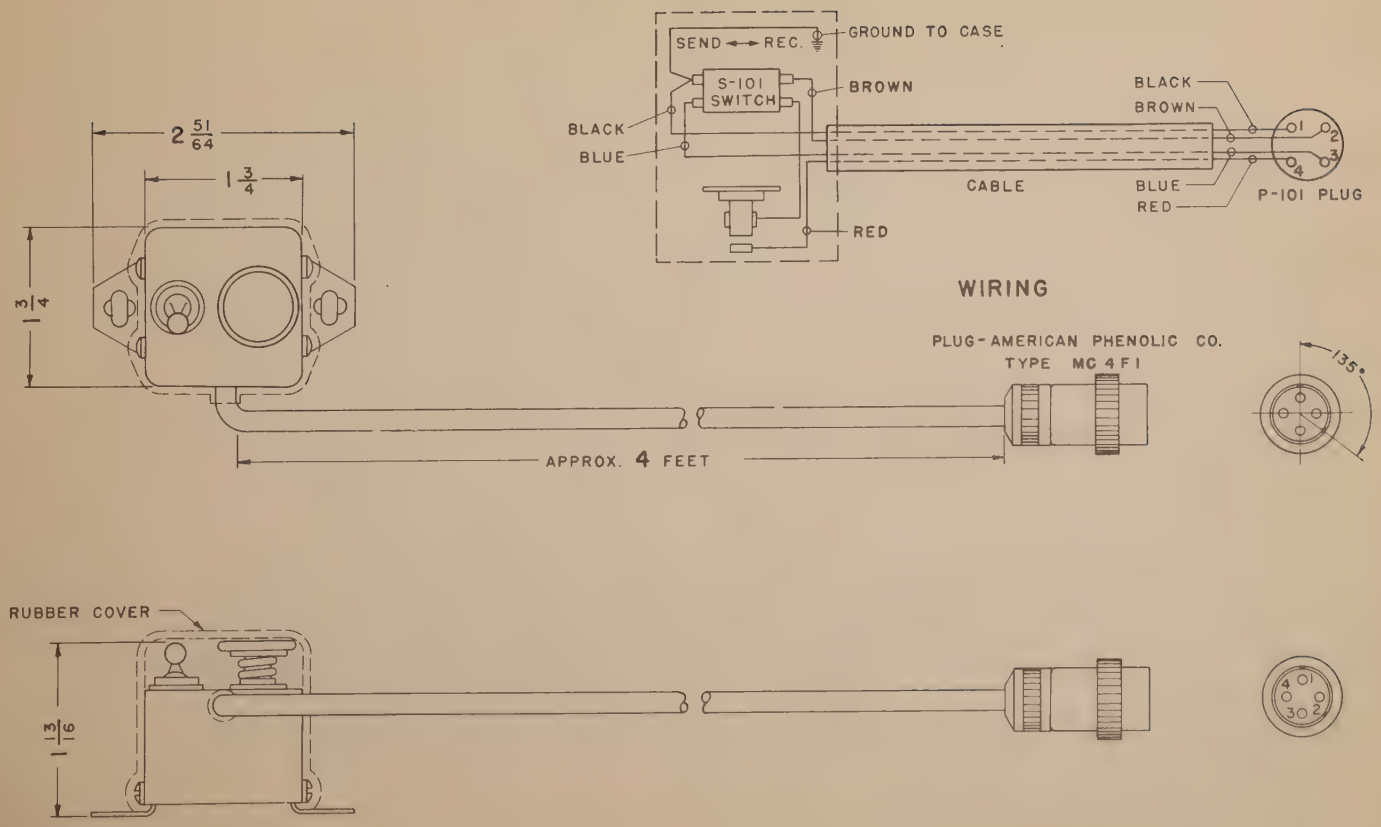


Fig. 14—Outline Drawing and Wiring Diagram, Key, Cord and Plug Assembly, Navy Type CRH-26013B, Drawing P-7708922

Fig. 14—Outline Drawing and Wiring Diagram, Key, Cord and Plug Assembly, Navy Type CRH-26013B, Drawing P-7708922

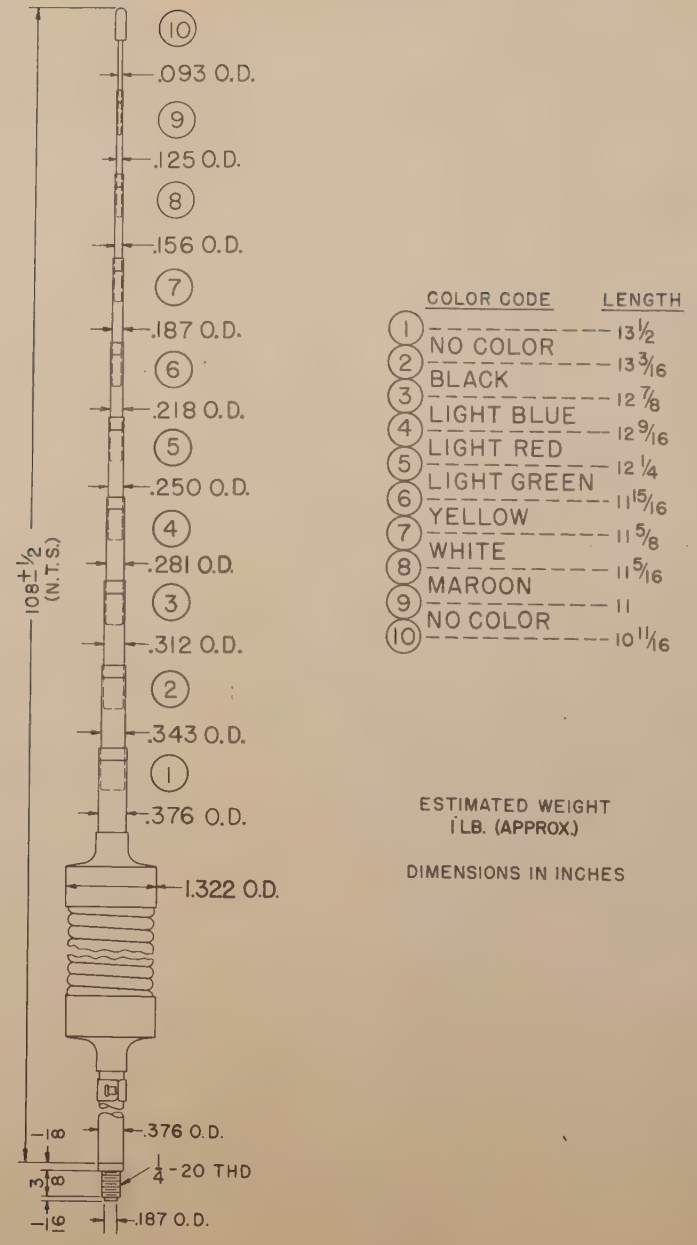
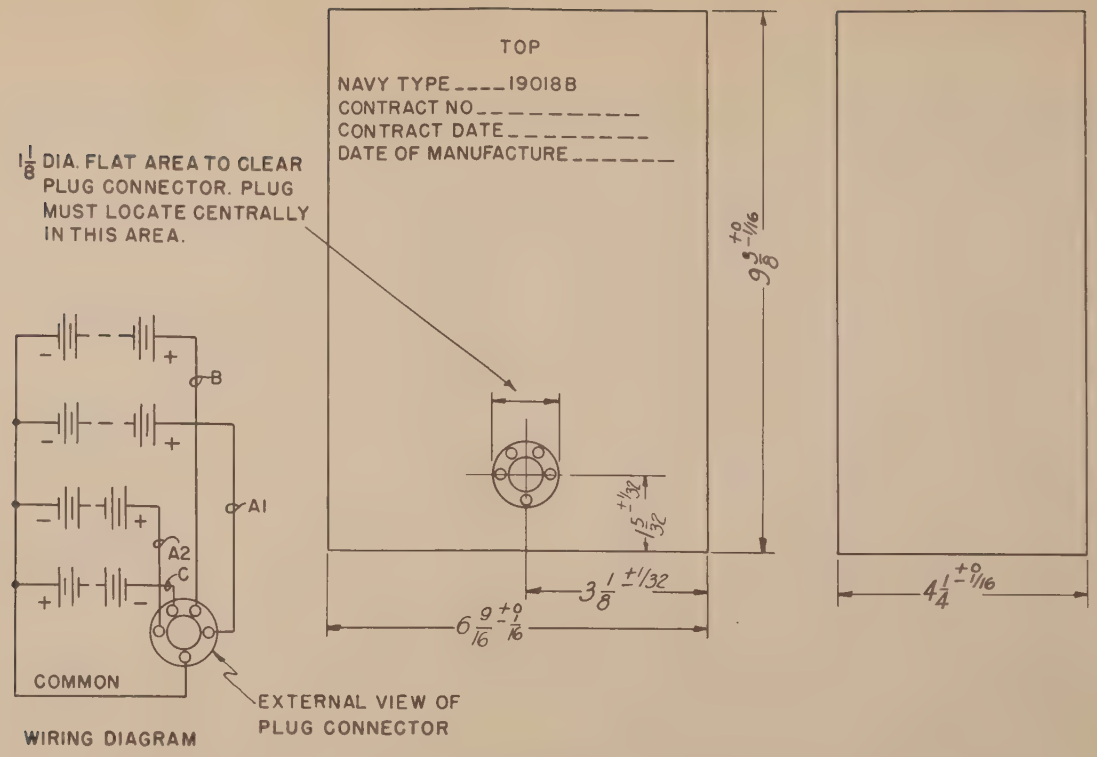


Fig. 15—Outline Drawing, Antenna, Navy Type CWN-66087 or CWN-66087-S, Drawing 51930

Fig. 15—Outline Drawing, Antenna, Navy Type CWN-66087 or CWN-66087-S, Drawing 51930



PERFORMANCE

THE BATTERY SHALL BE RATED AND PERFORM AS FOLLOWS:

VOLTAGE - EACH COMPLETED BATTERY PACK SHALL SHOW THE FOLLOWING VOLTAGES AS MEASURED BETWEEN THE COMMON TERMINAL AND THE TERMINAL INDICATED.

TERMINAL	VOLTAGES
B	+156
A1	+3.0
A2	+1.5
C	−7.5

EACH BATTERY THAT IS RANDOM SELECTED FOR TEST SHALL BE SUBJECTED TO SUCCESSIVE, ALTERNATE, FIFTEEN MINUTE, APPLICATIONS OF THE TWO LOAD CONDITIONS AS DESCRIBED BELOW UNTIL ANY ONE OF THE END VOLTAGES, AS INDICATED IN THE FOLLOWING TABULATION HAS BEEN REACHED.

BATTERY PACK UNIT	LOAD CONDITION #1	LOAD CONDITION #2	END VOLTAGES UNDER LOAD #1
156 VOLT B	5200 OHMS	9800 OHMS	125 VOLTS,
3.0 VOLT A1	8 OHMS	10 OHMS	2.3 VOLTS
1.5 VOLT A2	7.5 OHMS	10 OHMS	1.28 VOLTS
7.5 VOLT C	375 OHMS	OPEN CIRCUIT	6.5 VOLTS

THE BATTERY WHEN DISCHARGED WITHIN 30 DAYS AFTER MANUFACTURE, UNDER THE ABOVE LOAD CONDITIONS, SHALL HAVE A LIFE OF NOT LESS THAN 25 HOURS

AT THE END OF 6 MONTHS AFTER MANUFACTURE, THE LIFE TEST SHALL NOT BE LESS THAN 15 HOURS.

Fig. 16—Outline Drawing, Circuit and Rating of Battery Pack, Navy Type CNC-19018B, Drawing 52053

Fig. 16—Outline Drawing, Circuit and Rating of Battery Pack, Navy Type CNC-19018B, Drawing 52053

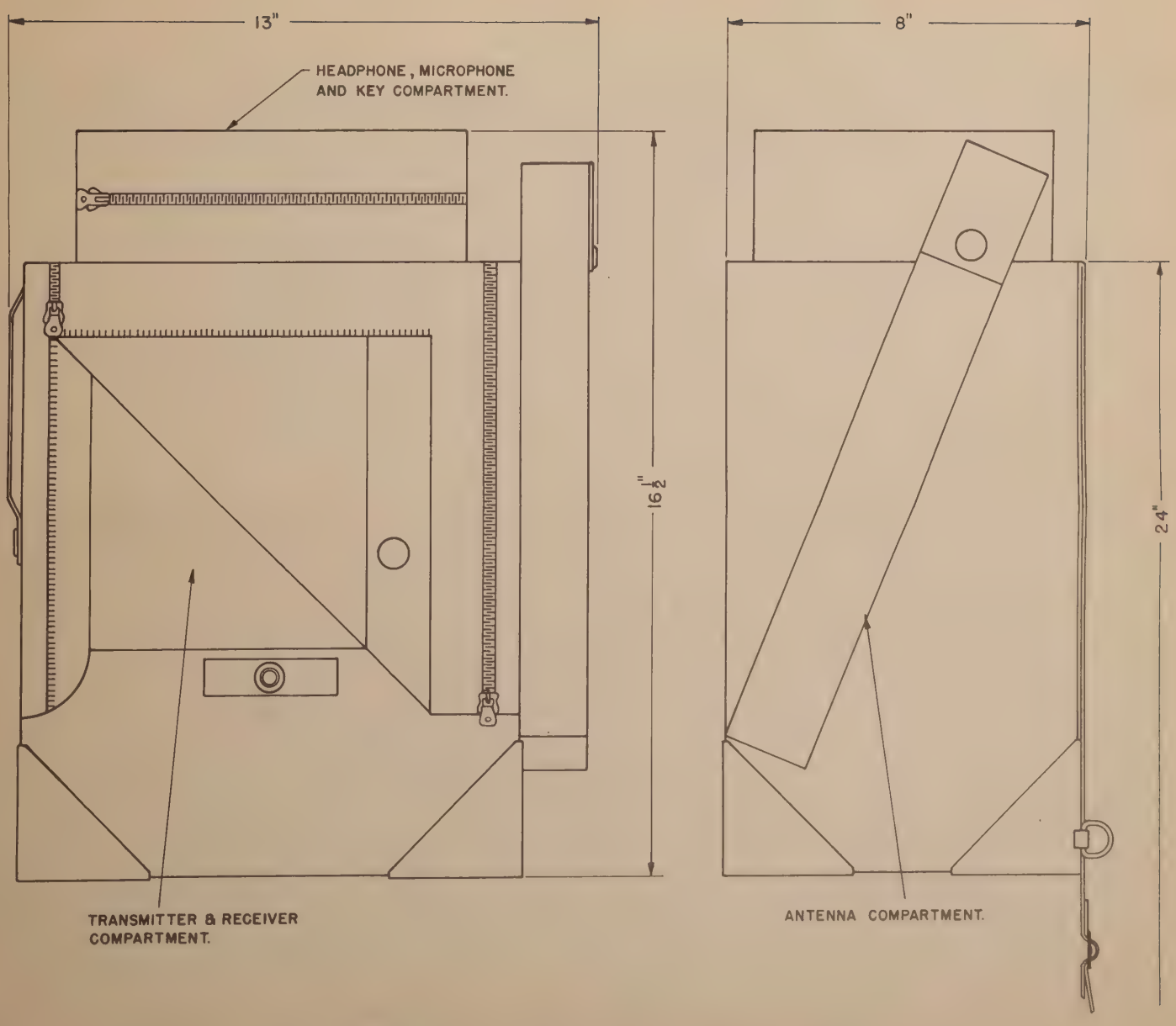


Fig. 17—Outline Drawing, Canvas Carrying Case, Navy Type CSS-10039B, Drawing 51957

Fig. 17—Outline Drawing, Canvas Carrying Case, Navy Type CSS-10039B, Drawing 51957

Fig. 18—Outline Drawing, Shipping Chest, Navy Type CFG-10197, Drawing 52061

Fig. 18—Outline Drawing, Shipping Chest, Navy Type CFG-10197, Drawing 52061

Fig. 19—Typical Tuning Data

SET DIALS TO CALIBRATION BY APPROACHING FROM LOW SIDE

Chan. No.	Freq. Mc.	Ant. Sec.	Trans. Band-Dial	Rec. Band-Dial
1	28.0	10	1-479	1-469
2	28.4	10	1-519	1-512
3	28.8	10	1-558	1-555
4	29.2	10	1-593	1-596
5	29.6	10	1-629	1-636
6*	30.0	10	1-663	1-676
7	30.4	10	1-695	1-711
8	30.8	10	1-733	1-745
9	31.2	10	1-765	1-779
10	31.6	10	1-798	1-810
11	32.0	10	1-829	1-841
12	32.4	10	1-861	1-871
13	32.8	8	2-182	1-899
14	33.2	8	2-224	1-927
15	33.6	8	2-265	1-955
16	34.0	8	2-298	1-979
17	34.4	8	2-331	1-1003
18	34.8	8	2-363	1-1026
*	35.0	8	2-377	1-1037
19	35.2	8	2-391	1-1048
20	35.6	8	2-419	1-1070
21	36.0	8	2-447	2-275
22	36.4	8	2-474	2-314
23	36.8	8	2-501	2-353
24	37.2	8	2-527	2-392
25	37.6	8	2-552	2-426
26	38.0	8	2-576	2-459
27	38.4	8	2-600	2-492
28	38.8	8	2-624	2-523
29	39.2	8	2-648	2-553
30	39.6	8	2-672	2-583
31*	40.0	8	2-696	2-612
32	40.4	8	2-720	2-641
33	40.8	8	2-743	2-669
34	41.2	8	2-765	2-694
35	41.6	8	2-787	2-718
36	42.0	8	2-808	2-742
37	42.4	8	2-831	2-767
38	42.8	8	2-853	2-792
39	43.2	8	2-875	2-816
40	43.6	8	2-898	2-838
41	44.0	8	2-920	2-859
42	44.4	8	2-942	2-880
43	44.8	8	2-953	2-900
*	45.0	8	2-963	2-910
44	45.2	8	2-984	2-919
45	45.6	8	2-1004	2-938
46	46.0	8	2-1024	2-957
47	46.4	8	2-1044	2-975
48	46.8	8	2-1063	2-993
49	47.2	8	2-1088	2-1011
50	47.6	6	3-306	2-1029
51	48.0	6	3-331	2-1047
52	48.4	6	3-356	3-196
53	48.8	6	3-381	3-228
54	49.2	6	3-405	3-259
55	49.6	6	3-428	3-286
56*	50.0	6	3-450	3-313
57	50.4	6	3-472	3-340
58	50.8	6	3-494	3-366
59	51.2	6	3-516	3-392
60	51.6	6	3-537	3-418
61	52.0	6	3-554	3-443
62	52.4	6	3-571	3-468
63	52.8	6	3-588	3-492
64	53.2	6	3-606	3-515
65	53.6	6	3-624	3-537
66	54.0	6	3-642	3-559
67	54.4	6	3-658	3-581
68	54.8	6	3-673	3-603
*	55.0	6	3-681	3-614
69	55.2	6	3-688	3-625
70	55.6	6	3-704	3-645
71	56.0	6	3-720	3-664
72	56.4	6	3-736	3-683
73	56.8	6	3-752	3-701
74	57.2	6	3-768	3-719
75	57.6	6	3-784	3-737
76	58.0	6	3-801	3-754
77	58.4	6	3-818	3-771
78	58.8	6	3-834	3-788
79	59.2	6	3-850	3-804
80	59.6	6	3-866	3-820
81*	60.0	6	3-881	3-836
82	60.4	6	3-898	3-850
83	60.8	6	3-915	3-864
84	61.2	6	3-932	3-878
85	61.6	6	3-947	3-893
86	62.0	6	3-962	3-908
87	62.4	6	3-977	3-923
88	62.8	6	3-992	3-936
89	63.2	6	3-1007	3-949
90	63.6	6	3-1022	3-962
91	64.0	6	3-1037	3-975
92	64.4	6	3-1052	3-988
93	64.8	6	3-1066	3-1001
*	65.0	6	3-1073	3-1008
94	65.2	6	3-1081	3-1014
95	65.6	5	4-405	4-452
96	66.0	5	4-421	4-471
97	66.4	5	4-437	4-490
98	66.8	5	4-453	4-509
99	67.2	5	4-468	4-527
100	67.6	5	4-482	4-545
101	68.0	5	4-496	4-563
102	68.4	5	4-510	4-581
103	68.8	5	4-526	4-598
104	69.2	5	4-542	4-614
105	69.6	5	4-558	4-630
106*	70.0	5	4-572	4-646
107	70.4	5	4-586	4-662
108	70.8	5	4-600	4-677
109	71.2	5	4-615	4-692
110	71.6	5	4-630	4-707
111	72.0	5	4-644	4-721
112	72.4	5	4-657	4-736
113	72.8	5	4-670	4-750
114	73.2	5	4-682	4-764
115	73.6	5	4-695	4-778
116	74.0	5	4-708	4-791
117	74.4	5	4-720	4-804
118	74.8	5	4-733	4-817
*	75.0	5	4-739	4-824
119	75.2	5	4-745	4-830
120	75.6	5	4-757	4-842
121	76.0	5	4-768	4-855
122	76.4	5	4-779	4-867
123	76.8	5	4-790	4-879
124	77.2	5	4-802	4-891
125	77.6	5	4-814	4-902
126	78.0	5	4-825	4-913
127	78.4	5	4-836	4-924
128	78.8	5	4-847	4-935
129	79.2	5	4-858	4-946
130	79.6	5	4-868	4-957
131*	80.0	5	4-878	4-967

*Crystal Calibration Point

Fig. 19—Typical Tuning Data

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